INSTALLATION, OPERATING AND SERVICE INSTRUCTIONS FOR

MPO - IQ™

3-PASS OIL Boiler

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ENERGY STAR

ASME H

ETL LISTED C US
Intertek
9700609

For service or repairs to boiler, call your heating contractor. When seeking information on boiler, provide Boiler Model Number and Serial Number as shown on Rating Label.

Boiler Model Number	Boiler Serial Number	Installation Date
MPO - IQ		
Heating Contractor		Phone Number
Address		

U.S. Boiler Company

103859-03 - 1/13

Price - $5.00

IMPORTANT INFORMATION - READ CAREFULLY

All boilers must be installed in accordance with National, State and Local Plumbing, Heating and Electrical Codes and the regulations of the serving utilities. These Codes and Regulations may differ from this instruction manual. Authorities having jurisdiction should be consulted before installations are made.
In all cases, reference should be made to the following Standards:

USA BOILERS

A. Current Edition of American National Standard ANSI/NFPA 31, "Installation of Oil Burning Equipment", for recommended installation practices.
B. Current Edition of American National Standard ANSI/NFPA 211, "Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances", For Venting requirements.
C. Current Edition of American Society of Mechanical Engineers ASME CSD-1, "Controls and Safety Devices for Automatically Fired Boilers", for assembly and operations of controls and safety devices.
D. All wiring on boilers installed in the USA shall be made in accordance with the National Electrical Code and/or Local Regulations.

CANADIAN BOILERS

A. Current Edition of Canadian Standards Association CSA B139, "Installation Code for Oil Burning Equipment", for recommended Installation Practices.
B. All wiring on boilers installed in Canada shall be made in accordance with the Canadian Electrical Code and/or Local Regulations.

The following terms are used throughout this manual to bring attention to the presence of hazards of various risk levels, or to important information concerning product life.

DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death, serious injury or substantial property damage.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in moderate or minor injury or property damage.

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death, serious injury or substantial property damage.

NOTICE

Indicates special instructions on installation, operation, or maintenance which are important but not related to personal injury hazards.

NOTICE

This boiler has a limited warranty, a copy of which is included with this boiler.
The warranty for this boiler is valid only if the boiler has been installed, maintained and operated in accordance with these instructions.

Surface rust on cast iron sections may be attributed to the manufacturing process as well as condensation during storage. Surface rust is normal and does not affect the performance or longevity of a boiler.

DANGER

DO NOT store or use gasoline or other flammable vapors or liquids in the vicinity of this or any other appliance.

WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Failure to follow all instructions in the proper order can cause personal injury or death. Read and understand all instructions, including all those contained in component manufacturers manuals which are provided with the boiler before installing, starting-up, operating, maintaining or servicing this boiler. Keep this manual and literature in legible condition and posted near boiler for reference by owner and service technician.

This boiler requires regular maintenance and service to operate safely. Follow the instructions contained in this manual.

Installation, maintenance, and service must be performed only by an experienced, skilled and knowledgeable installer or service agency.

All heating systems should be designed by competent contractors and only persons knowledgeable in the layout and installation of hydronic heating systems should attempt installation of any boiler.

Installation is not complete unless a pressure relief valve is installed into the 3/4" tapping located on return injector assembly that was installed into boss on top of rear section - See "Packaged Boiler Assy - Trim & Controls", "Unit-Pak Boiler Assy - Trim & Controls" and "Water Boiler Piping" Sections of this manual for details.

It is the responsibility of the installing contractor to see that all controls are correctly installed and are operating properly when the installation is completed.

This boiler is suitable for installation on combustible flooring. Do not install boiler on carpeting.

Do not tamper with or alter the boiler or controls.

Inspect flueways at least once a year - preferably at the start of the heating season. The inside of the combustion chamber, the vent system and boiler flueways should be cleaned if soot or scale has accumulated.

When cleaning this boiler, take precaution to avoid damage to burner swing door insulation. If damaged, or if there is evidence of previous damage, burner swing door insulation must be replaced immediately.

Oil Burner and Controls must be checked at least once a year or as may be necessitated.

Do not operate boiler with jumpered or absent controls or safety devices.

Do not operate boiler if any control, switch, component, or device has been subject to water.

Boiler construction materials, products of combustion and the fuel contain alumina, silica, heavy metals, carbon monoxide, nitrogen oxides, aldehydes and/or other toxic or harmful substances which can cause death or serious injury and which are known to the state of California to cause cancer, birth defects and other reproductive harm. Always use proper safety clothing, respirators and equipment when servicing or working nearby the appliance.

This boiler contains very hot water under high pressure. Do not unscrew any pipe fittings nor attempt to disconnect any components of this boiler without positively assuring the water is cool and has no pressure. Always wear protective clothing and equipment when installing, starting up or servicing this boiler to prevent scald injuries. Do not rely on the pressure and temperature gauges to determine the temperature and pressure of the boiler. This boiler contains components which become very hot when the boiler is operating. Do not touch any components unless they are cool.

WARNING

This boiler must be properly vented. The chimney must be inspected for any obstructions and cleaned prior to each heating season. A clean and unobstructed chimney flue is necessary to produce the minimum draft required to safely evacuate noxious fumes that could cause personal injury or loss of life. Evidence of loose debris and or condensate induced stains at the base of the chimney flue, connector or smokepipe joints may be signs of condensing flue gases. Flue gas condensate is corrosive, which requires special consideration and must be addressed immediately. Refer to Section V, "Venting" or Section VI "Direct Venting / Air Intake Piping".

This boiler needs fresh air for safe operation and must be installed so there are provisions for adequate combustion and ventilation air.

This boiler is supplied with controls which may cause the boiler to shut down and not re-start without service. If damage due to frozen pipes is a possibility, the heating system should not be left unattended in cold weather; or appropriate safeguards and alarms should be installed on the heating system to prevent damage if the boiler is inoperative.

This boiler is designed to burn No. 2 fuel oil only. Do not use gasoline, crankcase drainings, or any oil containing gasoline. Never burn garbage or paper in this boiler. Do not convert to any solid fuel (i.e. wood, coal). Do not convert to any gaseous fuel (i.e. natural gas, LP). All flammable debris, rags, paper, wood scraps, etc., should be kept clear of the boiler at all times. Keep the boiler area clean and free of fire hazards.

All boilers equipped with burner swing door have a potential hazard which, if ignored, can cause severe property damage, personal injury or loss of life. Before opening swing door, unplug burner power cord from receptacle located in lower right corner of jacket front panel and turn off service switch to boiler to prevent accidental firing of burner outside the combustion chamber. Be sure to tighten swing door fasteners completely when service is completed.

TABLE OF CONTENTS

I.	Pre-Installation	8
II.	Packaged Boiler Assy. - Trim & Controls	11
III.	Unit-Pak Boiler Assy. - Trim & Controls	20
IV.	Water Boiler Piping	26
V.	Natural Draft Venting	30
VI.	Direct Venting / Air Intake Piping	34
VII.	Electrical	41
VIII.	Oil Piping	45
IX.	System Start-Up	47
X.	Operating	52
XI.	Maintenance & Service Instructions	57
XII.	Boiler Cleaning	59
XIII.	Trouble Shooting	61
XIV.	Repair Parts	69
XV.	Burner Specifications	83
	Appendix A - IQ Oil Control System	85
	Appendix B - Figures	89
	Appendix C - Tables	91

Congratulations on your purchase of a new MPO-IQ™ boiler—designed and constructed to provide you with years of reliable service.

- *ENERGY STAR™ efficiency* – friendly on the environment and your wallet.
- *Cast iron heat exchanger* – for reliability and durability, nothing beats a cast iron heat exchanger.
- ***IQ Control™ System*– the most advanced and easiest to use controls available.
- *System-friendly* – built-in protection from condensation and thermal shock.

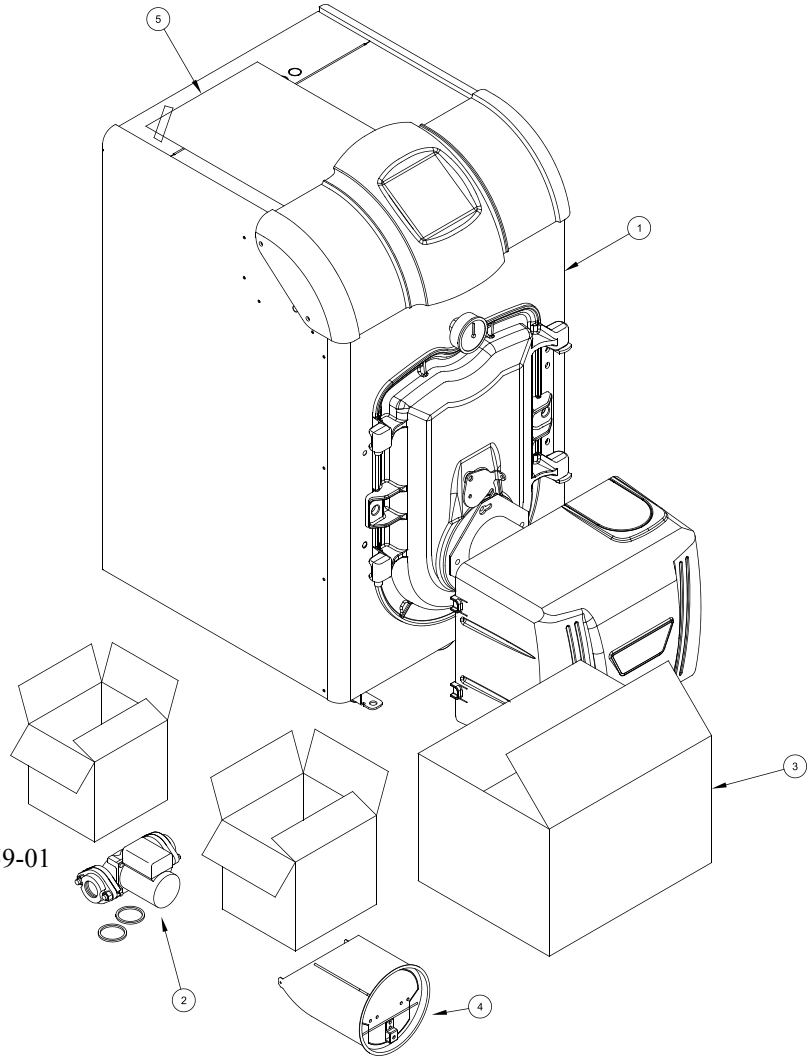
***IQ Control System Overview**

MPO-IQ Boiler uses a microprocessor based control system called the "IQ Control System". This "IQ Control System" consists of an IQ Oil Boiler Control (Boiler Control) in conjunction with an Oil Primary Control (Oil Primary)and an IQ Option Panel (Option Panel) with optional "plug-in" IQ Option Cards (Option Card). The IQ Control System fully integrates both factory and field installed components, simplifying installation and troubleshooting. The IQ Control System is designed to efficiently operate the entire boiler system to save energy and installation and setup time, while ensuring adequate supply of heat and domestic hot water.

What's in the crate?

Content Check List

1. MPO-IQ Boiler Assembly on Shipping Skid:
   - ___ MPO-IQ84
   - ___ MPO-IQ115
   - ___ MPO-IQ147
   - ___ MPO-IQ189
   - ___ MPO-IQ231
2. Circulator & Gasket Kit:
   - ___ Taco 007-2 - P/N 8056170
   - ___ Grundfos UP-15 - P/N 102805-01
   - ___ B & G NRF-22 - P/N 8056174
3. Parts Carton:
   - ___ MPO-IQ84 - P/N 103088-01
   - ___ MPO-IQ115 - P/N 103088-02
   - ___ MPO-IQ147/231 - P/N 103088-03
4. Barometric Draft Regulator Carton
   - ___ 5" Dia. - P/N 8116287
   - ___ 6" Dia. - P/N 8116288
   - ___ 7" Dia. - P/N 8116289
5. Instruction Envelope - P/N 103858-01
   - ___ Installation & Operation Manual - P/N 103859-01
   - ___ Boiler Warranty Sheet - P/N 103203-01
   - ___ Boiler Warranty Card - P/N 103204-01
   - ___ Hydronics Institute (AHRI) Instructions - P/N 81460061



BOILER MODEL NO.	DIMENSIONS			WATER CONTENT (GALLONS)	HEAT TRANSFER SURFACE AREA (SQ. FT.)	APPROX. SHIPPING WEIGHT (LBS.)
	'A'	'B'	'C'			
MPO-IQ84/115	16 5/8"	24"	5"	7.70	13.29	430
MPO-IQ147	22 5/8"	24"	6"	11.08	20.29	545
MPO-IQ189	28 5/8"	30"	6"	14.46	27.29	658
MPO-IQ231	34 5/8"	36"	7"	17.84	34.29	771

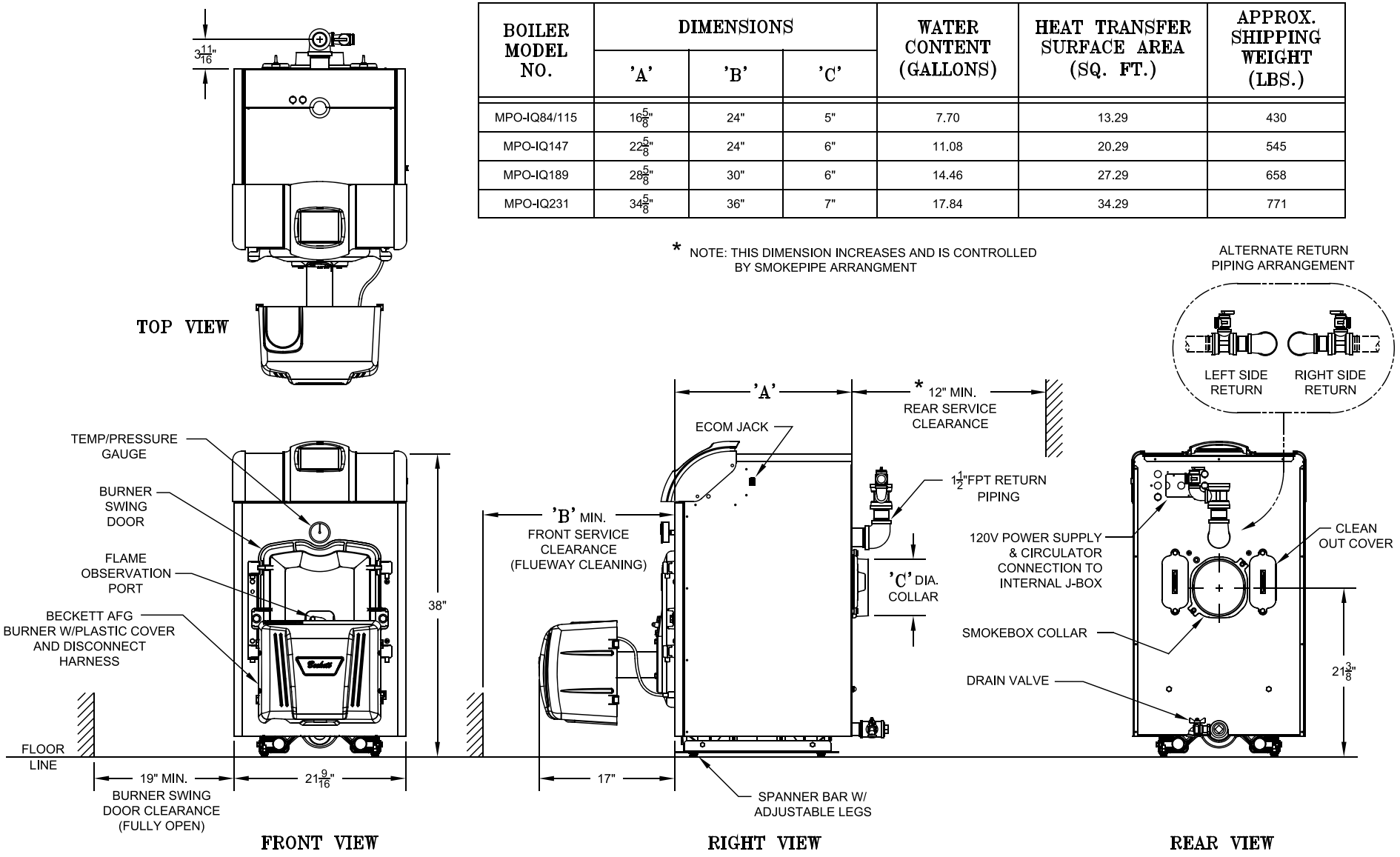


Figure 1: MPO-IQ84 Thru MPO-IQ231 Water Boiler

TABLE 1A: DIMENSIONAL DATA (SEE FIGURE 1)

Boiler Model No.	Dimensions See Figure 1			Water Content - Gallons	Heat Transfer Surface Area - Sq. Ft.	Actual Shipping Weight (LB.)
	"A"	"B"	"C"			
MPO-IQ84	16-5/8"	24"	5"	7.70	13.29	430
MPO-IQ115	16-5/8"	24"	5"	7.70	13.29	430
MPO-IQ147	22-5/8"	24"	6"	11.08	20.29	545
MPO-IQ189	28-5/8"	30"	6"	14.46	27.29	658
MPO-IQ231	34-5/8"	36"	7"	17.84	34.29	771

NOTE: 1. Maximum Working Pressure: Water: 30 PSI Shipped From Factory (Standard), 40 PSI Optional, 50 PSI Optional

TABLE 1B: RATING DATA

Boiler Model No.	Burner Capacity			NET AHRI Ratings	AFUE %	Minimum Chimney Requirements			Direct Vent System	
	GPH	MBH	DOE Heating Capacity MBH	Water MBH	Water Boiler	Round In. Dia.	Rectangle In. x In.	Height Ft.	Model	Vent Connector Dia. Inch
MPO-IQ84	0.60	84	74	64	87	6	8 x 8	15	N/A	N/A
MPO-IQ115	0.82	115	101	87	87	6	8 x 8	15	N/A	N/A
MPO-IQ147	1.05	147	129	112	87	6	8 x 8	15	FDVS-56	5
MPO-IQI89	1.35	189	167	145	87	7	8 x 8	15	FDVS-56	5
MPO-IQ231	1.65	231	203	177	87	7	8 x 8	15	FDVS-67	6

I. PRE-INSTALLATION

A. **INSPECT SHIPMENT** carefully for any signs of damage.

1. All equipment is carefully manufactured, inspected and packed. Our responsibility ceases upon delivery of crated boiler to the carrier in good condition.
2. Any claims for damage or shortage in shipment must be filed immediately against the carrier by the consignee. No claims for variances from, or shortage in orders, will be allowed by the manufacturer unless presented within sixty (60) days after receipt of goods.

B. **LOCATE BOILER** in front of final position before removing crate. See Figure 1.

1. LOCATE so that vent pipe connection to chimney will be short and direct.
2. BOILER IS SUITABLE FOR INSTALLATION ON COMBUSTIBLE FLOOR. Boiler cannot be installed on carpeting.
3. FOR BASEMENT INSTALLATION, provide a solid elevated base, such as concrete, if floor is not level, or if water may be encountered on floor around boiler.
4. PROVIDE RECOMMENDED SERVICE CLEARANCE, if applicable, as follows:
   a. Clearance from Jacket Front Panel -
      - 24" for servicing burner
      - 24" for flueway cleaning (MPO-IQ84 thru 147)
      - 30" for flueway cleaning (MPO-IQ189)
      - 36" for flueway cleaning (MPO-IQ231)
   b. Clearance from Jacket Side Panels -
      - 19" for burner swing door, if opened fully with burner mounted, otherwise 1" with burner removed.
      - 12" access clearance to service rear of boiler if other side clearance is less than 12".
      - 3" minimum if other side clearance is 12" or larger to access and service rear of boiler.
   c. Clearance from Jacket Rear Panel -
      - 12" minimum for rear smokebox cleaning

        (Note: This dimension will also be controlled by horizontal to vertical to horizontal smokepipe arrangement - **Chimney Vent** (see Figures 2A and 15).
      - 24" for rear smokebox cleaning and disconnecting vent pipe from appliance adapter for servicing (if required) - **Direct Vent** (see Figure 2B).
5. For minimum clearances to combustible materials. See Figures 2A and 2B.

NOTICE

Clearance to venting is for single wall vent pipe. If Type L vent is used, clearance may be reduced to the minimum required by the vent pipe manufacturer.

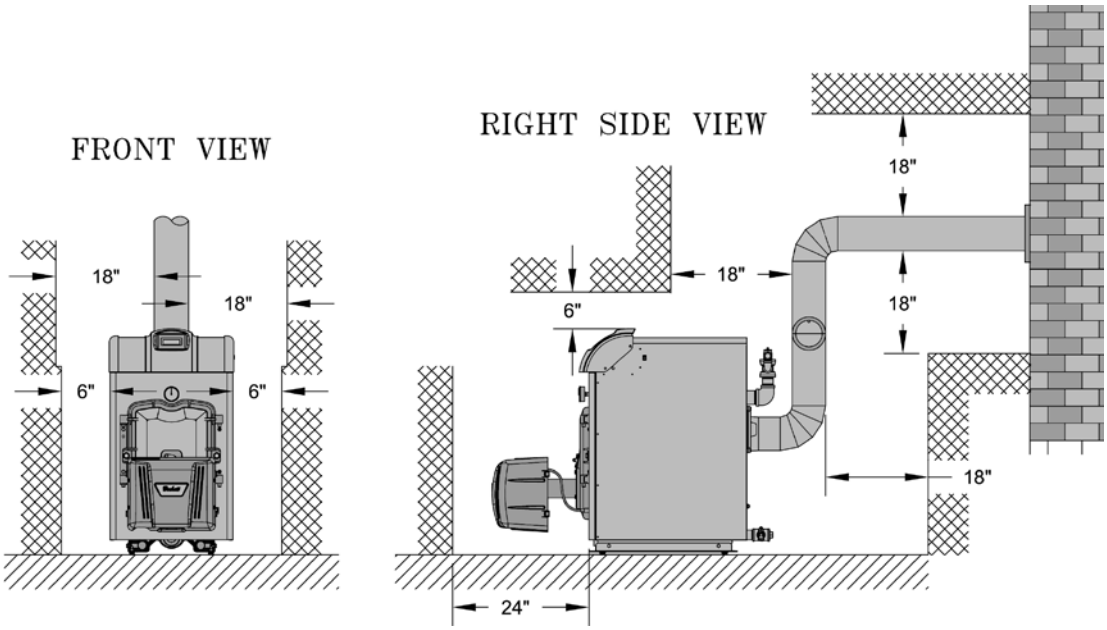


Figure 2A: Chimney Vented Boiler - Minimum Installation Clearances To Combustible Materials (Inches)

NOTES:

1. Listed clearances comply with American National Standard ANSI/NFPA 31, Installation of Oil Burning Equipment.
2. MPO-IQ boilers can be installed in rooms with clearances from combustible material as listed above. Listed clearances cannot be reduced for alcove or closet installations.
3. For reduced clearances to combustible material, protection must be provided as described in the above ANSI/NFPA 31 standard.

I. PRE-INSTALLATION (continued)

C. PROVIDE COMBUSTION AND VENTILATION AIR. Local and National Codes may apply and should be referenced.

WARNING

Adequate combustion and ventilation air must be provided to assure proper combustion and to maintain safe ambient air temperatures.

Do not install boiler where gasoline or other flammable vapors or liquids, or sources of hydrocarbons (i.e. bleaches, fabric softeners, etc.) are used or stored.

1. Determine volume of space (boiler room). Rooms communicating directly with the space in which the appliances are installed, through openings not furnished with doors, are considered a part of the space.

   Volume(ft^3) = Length(ft) x Width(ft) x Height(ft)

2. Determine total input of all appliances in the space.

   Add inputs of all appliances in the space and round the result to the nearest 1000 BTU per hour.

3. Determine type of space. Divide Volume by total input of all appliances in space. If the result is greater than or equal to 50 ft^3/1000 BTU per hour, then it is considered an ***unconfined space***. If the result is less than 50 ft^3/1000 BTU per hour then the space is considered a ***confined space***.

4. For boiler located in an *unconfined space of a conventionally constructed building*, the fresh air infiltration through cracks around windows and doors normally provides adequate air for combustion and ventilation.

5. For boiler located in a confined space or an unconfined space in a building of ***unusually tight construction***, provide outdoor air.

   a. Outdoor air for combustion may be provided with an optional Fresh Air Accessory Kit (**ONLY AVAILABLE WITH BECKETT BURNER**). Metal cover applications, P/N 611280031. Plastic cover applications, P/N 102119-01. Refer to Fresh Air Accessory Kit instructions for installation and air intake piping details. See Section V for installation details.

   or

   b. Outdoor air may be provided with the use of two permanent openings which communicate directly or by duct with the outdoors or spaces (crawl or attic) freely communicating with the outdoors. Locate one opening within 12 inches of top of space. Locate remaining opening within 12 inches of bottom of space. Minimum dimension of air opening is 3 inches. Size each opening per following:

      i. **Direct communication with outdoors.** Minimum free area of 1 square inch per 4,000 BTU per hour input of all equipment in space.

      ii. **Vertical ducts.** Minimum free area of 1 square inch per 4,000 BTU per hour input of all equipment in space. Duct cross-sectional area shall be same as opening free area.

      iii. **Horizontal ducts.** Minimum free area of 1 square inch per 2,000 BTU per hour input of all equipment in space. Duct cross-sectional area shall be same as opening free area.

      Alternate method for boiler located within confined space. Use indoor air if two permanent openings communicate directly with additional space(s) of sufficient volume such that combined volume of all spaces meet criteria for unconfined space. Size each opening for minimum free area of 1 square inch per 1,000 BTU per hour input of all equipment in spaces, but not less than 100 square inches.

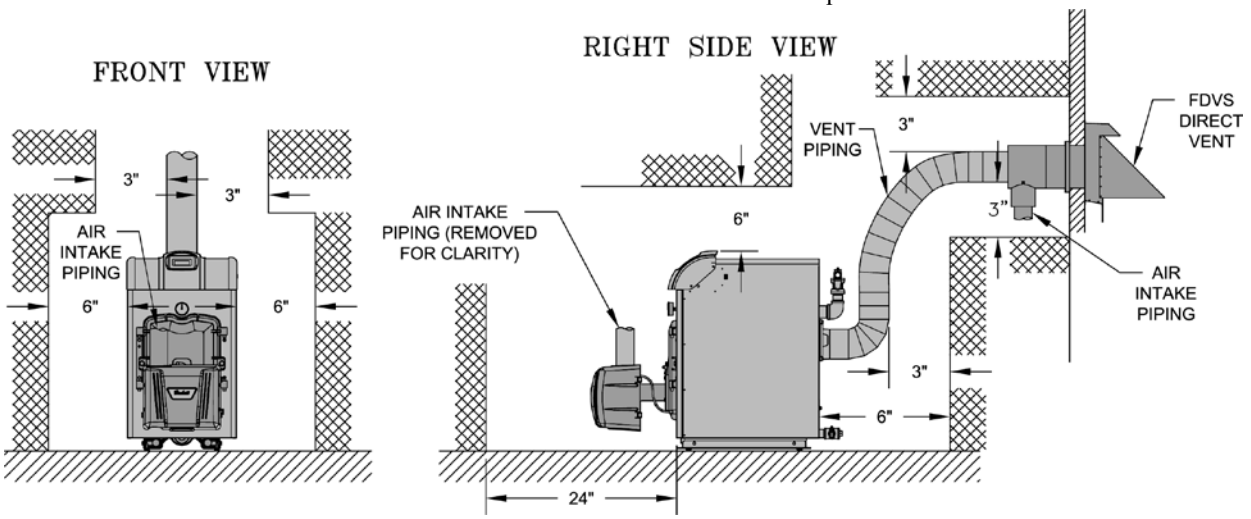


Figure 2B: Direct Vent Boiler - Minimum Installation Clearances To Combustible Materials (Inches)

6. Louvers and Grilles of Ventilation Ducts
   a. All outside openings should be screened and louvered. Screens used should not be smaller than 1/4 inch mesh. Louvers will prevent the entrance of rain and snow.
   b. Free area requirements need to consider the blocking effect of louvers, grilles, or screens protecting the openings. If the free area of the louver or grille is not known, assume wood louvers have 20-25 percent free area and metal louvers and grilles have 60-75 percent free area.
   c. Louvers and grilles must be fixed in the open position, or interlocked with the equipment to open automatically during equipment operation.

D. <u>DIRECT VENT CONFIGURATIONS</u> requires:

1. Beckett NX Burner
2. Direct Vent Conversion Kit
3. Double Wall Flex Oil Vent Pipe (FOVP)

TABLE 2: DIRECT VENT CONFIGURATION COMPONENTS

Boiler Model No.	Beckett NX Oil Burner Part No.	Direct Vent Conversion Kit Part No.	FOVP Carton Part No.
MPO-IQ147	100240-02	102130-02	100211-02 - 5 ft.
			100212-02 - 10 ft.
MPO-IQ189	100240-03		100213-02 - 15 ft.
			100214-02 - 20 ft.
MPO-IQ231	100240-04	102130-03	100211-03 - 5 ft.
			100212-03 - 10 ft.
			100213-03 - 15 ft.
			100214-03 - 20 ft.

II. PACKAGED BOILER ASSEMBLY - TRIM & CONTROLS

A. REMOVE CRATE.

1. Remove all fasteners at crate skid.
2. Lift outside container and remove all other inside protective spacers and bracing. Remove miscellaneous parts carton.

B. REMOVE BOILER FROM SKID.

1. To reduce the risk of damage to boiler jacket, use the following procedure to remove from skid, see Figure 3:

Step 1. Boiler is secured to base with (4) 5/16" cap screws, (2) in front and (2) in rear of shipping skid, see Figure 3. Remove all securing hardware.

Step 2. Place wooden block(s) 12" from rear of skid as shown (one piece 4" x 4" x 16" lg. or two pieces of 2" x 4" x 16" lg.)

Step 3. Insert 1" Sch. 40 pipe handles through leg hole in front and rear legs. Center end of pipe on wooden blocks as shown in Figure 3.

NOTE: Pipe handles should extend a minimum of 48" beyond jacket front panel for best leverage.

Step 4. Using the pipe handles, lift boiler until adjustable legs are elevated above the deck boards.

Step 5. Remove skid from underneath the boiler.

Step 6. Lower pipe handles until front adjustable legs touch floor. If necessary, place wooden blocks under front legs before lowering to provide hand clearance.

Step 7. To lower rear of boiler, tilt boiler slightly forward by pushing on smokebox collar or lift pipes protruding through rear legs until wooden blocks can be removed (see Figure 3). Slowly allow the weight of the boiler to tilt backward until rear legs rest on floor.

Step 8. If wood block was placed under front legs, lift pipe handles, remove wooden block and lower front legs to floor. Remove pipe handles.

CAUTION

Do not drop boiler. Do not bump boiler jacket against floor.

C. MOVE BOILER TO PERMANENT POSITION by sliding or walking.

D. PROCEDURE TO OPEN, CLOSE AND SECURE BURNER SWING DOOR

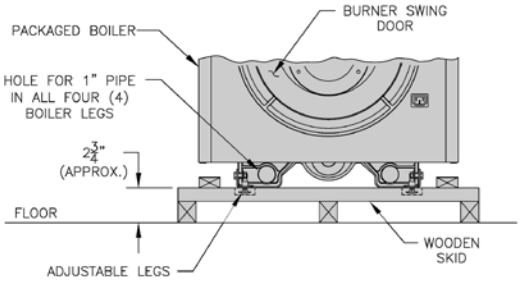
Throughout this manual you will be instructed to open and close the burner swing door for various reasons. There is a proper and improper method to closing and securing the burner swing door opened for inspection, cleaning or field service.

1. **TO OPEN BURNER SWING DOOR** (see Figures 4A and 4B).

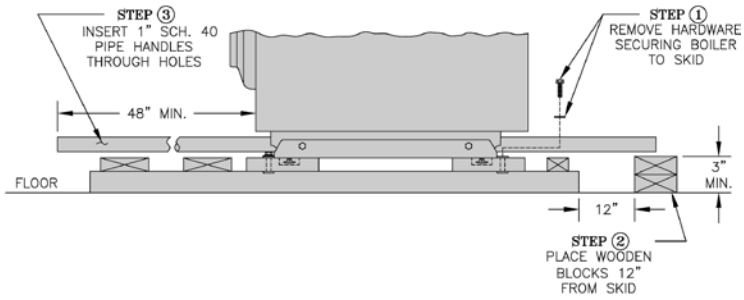
Step 1. Loosen but do not remove left side latching hardware (3/8" x 1-3/4" lg. tap bolt).

Step 2. Loosen and remove right side latching hardware (3/8" x 1-3/4" lg. tap bolt and washer).

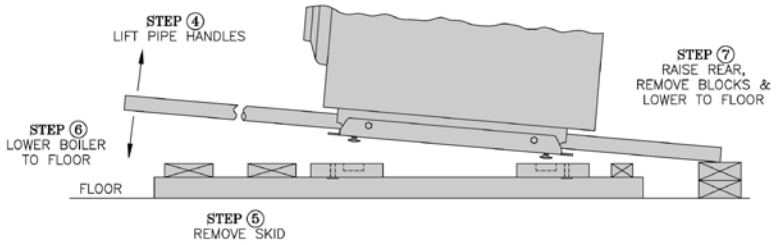
Step 3. Remove left side latching hardware (3/8" x 1-3/4" lg. tap bolt and washer).



PARTIAL FRONT VIEW


STEP ③ INSERT 1" SCH. 40 PIPE HANDLES THROUGH HOLES
STEP ① REMOVE HARDWARE SECURING BOILER TO SKID
48" MIN.
FLOOR
3" MIN.
12"
STEP ② PLACE WOODEN BLOCKS 12" FROM SKID

PARTIAL SIDE VIEW NO. 1


STEP ④ LIFT PIPE HANDLES
STEP ⑦ RAISE REAR, REMOVE BLOCKS & LOWER TO FLOOR
STEP ⑥ LOWER BOILER TO FLOOR
FLOOR
STEP ⑤ REMOVE SKID

PARTIAL SIDE VIEW NO. 2

Figure 3: Packaged Boiler Removal from Skid

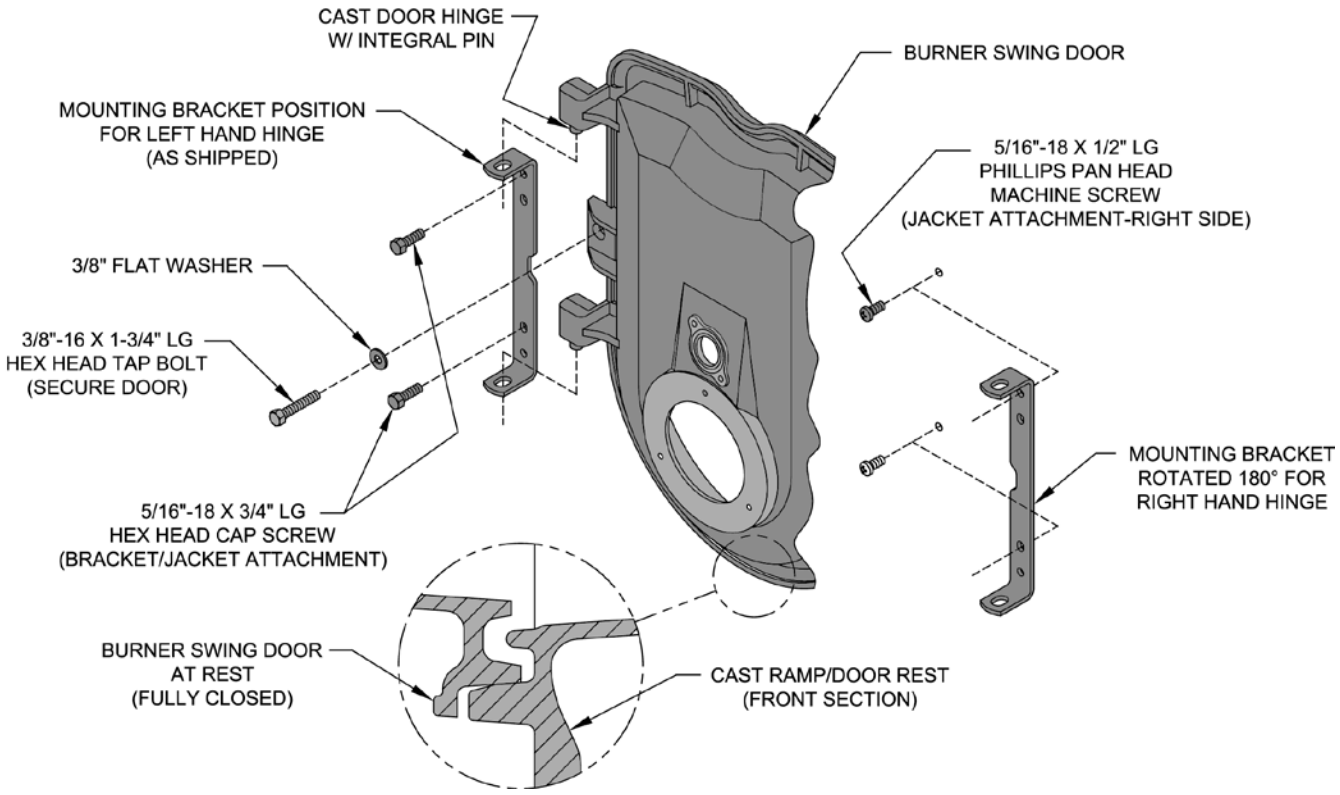


Figure 4A: Partial Front View - Burner Swing Door Mounted to Boiler - Fully Closed and Secured

Step 4. Disconnect burner power cord from receptacle located in lower right corner of jacket front panel.

Step 5. Door can be swung to the fully open position, approximately 90° to 120°, with the burner mounted providing that there is 19" of clearance to the adjacent wall, see Figures 1 and 4B.

NOTE: If reduced clearance prevents the door from opening fully, one of the following can provide full access:

a. Burner can be removed to allow full rotation of door.

b. Door with burner mounted can be lifted off mounting bracket and set aside during servicing.

c. The door mounting hardware is reversible from left side hinge (as shipped) to right side hinge.

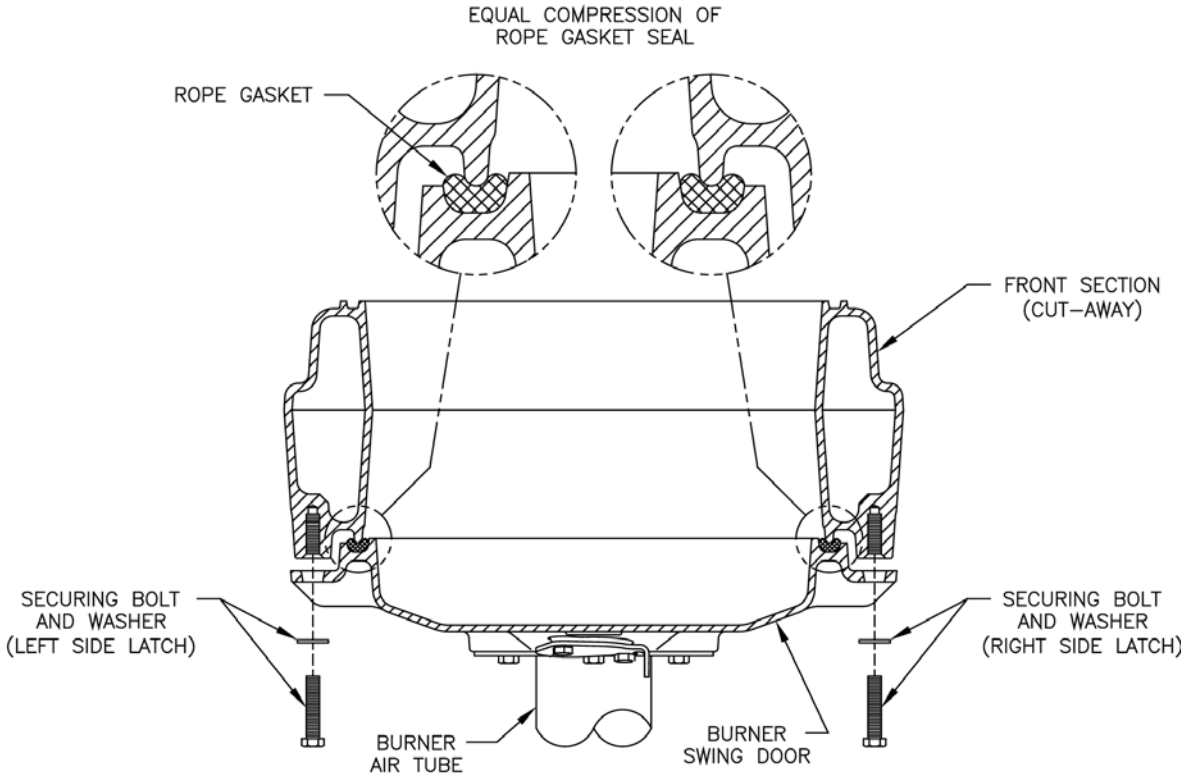
To reverse hinge arrangement (see Figure 4A):

- Lift door off mounting bracket and set aside.
- Remove mounting bracket and hardware from left side.
- Remove upper jacket front panel retaining screw (5/16" x 1/2" lg. Phillip Pan head machine screw) from right side of door and re-install in vacated upper mounting bracket tapping. Do not tighten.
- Move lower jacket panel retaining screw from right side to left tapping. Do not tighten.
- Rotate door mounting bracket 180°. Insert 5/16" cap screw through top hole in bracket and install in upper vacated jacket hole on right side of door.
- Install second 5/16" cap through bracket hole into lower vacated tapping on right side.
- Tighten both sets of hardware to secure jacket and mounting bracket.
- Lift door and place integral cast hinge pins on door into slotted mounting bracket holes.

2. Perform routine inspection, service or cleaning as necessary.

3. To close Burner Swing Door (see Figures 4A and 4B):

Step 1. From the fully open position, rotate Burner Swing Door to the closed position.



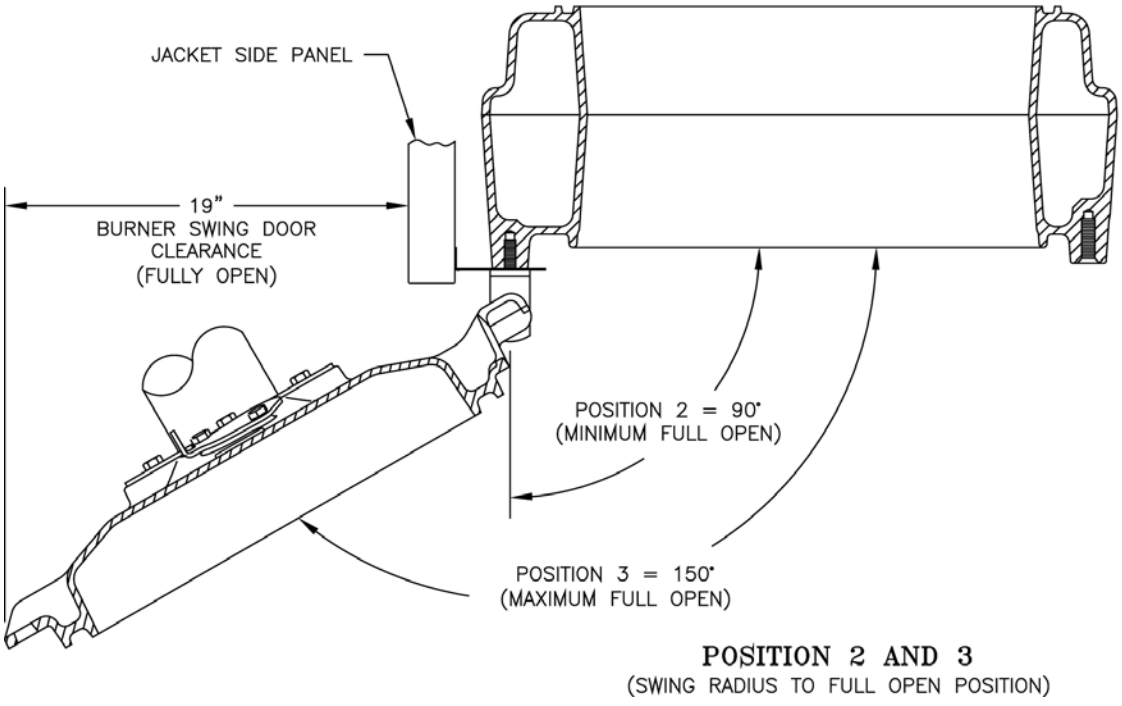


Figure 4B: Top View - Burner Swing Door Mounted to Cast Iron Block Assembly (Jacket Removed for Clarity)

Step 2. If necessary, place your right hand under the burner air tube to lift upward. Lift the door up unto the built-in cast ramp/door rest (protruding from the bottom of the front section casting - see Figure 4A).

Step 3. Use one hand to help hold door in position by lifting up on rear burner housing or applying pressure directly to the door while re-installing the securing hardware with your opposite hand. **Always install right side latching hardware (3/8"-16 x 1-3/4" lg. tap bolt and flat washer) first,** then install left side hinge hardware **(3/8"-16 x 1-3/4" lg. tap bolt and flat washer) second.** Apply additional pressure while hand tightening the hardware as far as possible, then release the pressure.

NOTICE

When securing burner swing door make sure door is drawn-in equally on both sides.

Step 4. Use a hand wrench to tighten door hardware and **always start with the right side cap screw first.** Use an alternating tightening method from right side tap bolt to left side tap bolt to tighten door equally until sealed without applying excessive torque. **Never** tighten left side flange bolt first or tighten either piece of hardware 100% without using the alternating tightening method described above.

Failure to follow the prescribed procedure could cause thread damage to casting or a leak in the door seal. If left side tap bolt is tightened before right side tap bolt, right side of door can not be drawn-in to provide an air tight seal, as shown in Figure 4C. Applying excessive torque will only cause thread damage.

E. INSPECT SWING DOOR INSULATION AND ROPE GASKET.

1. Open burner swing door using procedure previously outlined in Paragraph D of this section.
2. Inspect fiberglass rope located on the swing door. The rope must be evenly distributed around the perimeter of the door groove and cannot bunch or overhang. There must not be a gap where the two ends of the rope meet. Repair or replace if the rope is damaged or if there is a gap between the ends.
3. Inspect burner swing door insulation for damage and proper type, refer to Figure 4D.
   a. By design, cast bars on front section between the combustion chamber and between the left and right side 2nd and 3rd pass flueway should make an impression in door insulation to seal the chambers.
   b. By design, door insulation on model MPO-IQ231 will have two (2) by-pass pockets cast into the insulation centered on the bar between the combustion chamber and 3rd pass flueways.

      On models MPO-IQ84 thru MPO-IQ189 these pockets should not be present. If insulation is damaged or not of proper type regarding pockets, it must be replaced.
4. Do not close and secure door at this time, proceed to Field Assembly Details, Paragraph F.

F. FIELD ASSEMBLY OF BOILER

Open miscellaneous parts carton and remove contents. Identify the components using the illustrations (Figures 5 thru 9) throughout the assembly sequence outlined below as it applies to your installation.

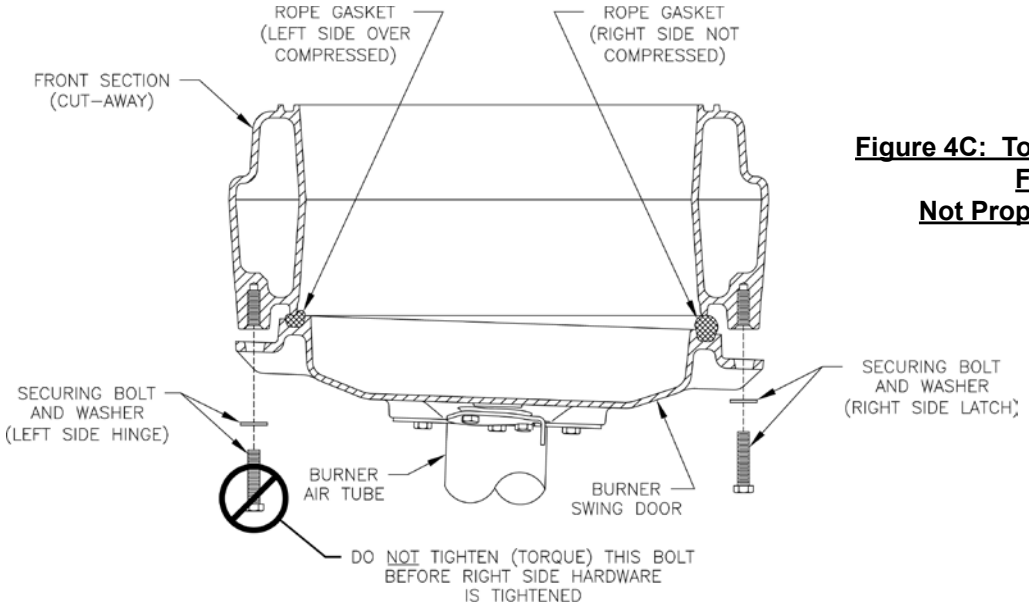

ROPE GASKET (LEFT SIDE OVER COMPRESSED)
ROPE GASKET (RIGHT SIDE NOT COMPRESSED)
FRONT SECTION (CUT–AWAY)
SECURING BOLT AND WASHER (LEFT SIDE HINGE)
SECURING BOLT AND WASHER (RIGHT SIDE LATCH)
BURNER AIR TUBE
BURNER SWING DOOR
DO NOT TIGHTEN (TORQUE) THIS BOLT BEFORE RIGHT SIDE HARDWARE IS TIGHTENED

Figure 4C: Top View - Burner Swing Door Fully Closed but Not Properly Secured or Sealed

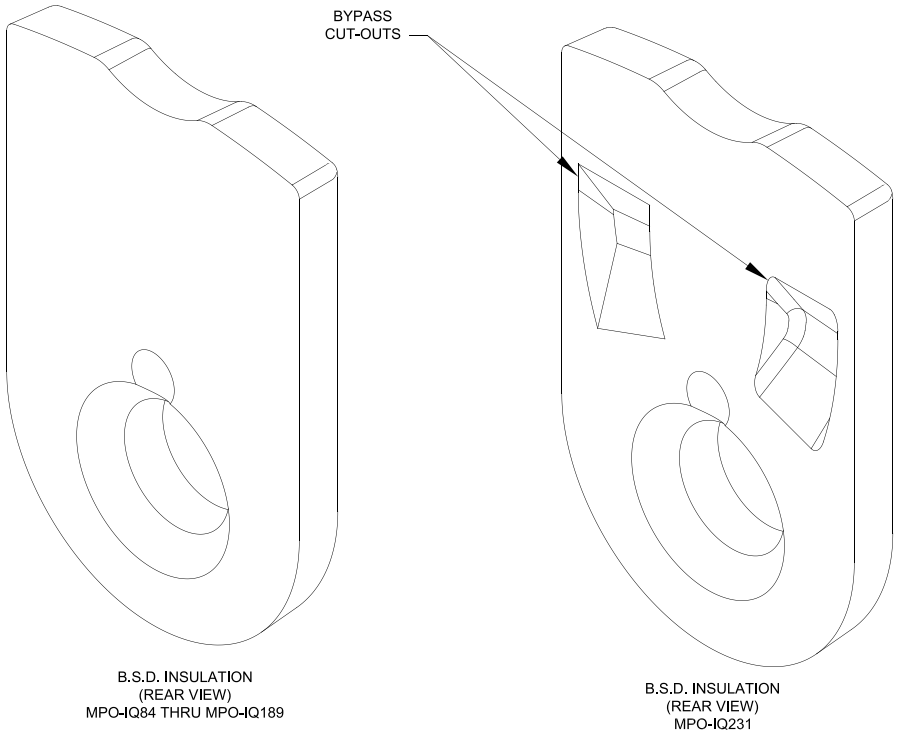


Figure 4D: Burner Swing Door Insulation

1. Install return injector piping and relief valve, refer to Figure 5.

   Step a. Locate the return pipe fittings and injector. Apply sealant to the 2" NPT injector threads. Insert injector into 2" NPT upper rear tapping on rear section. Thread 2" NPT x 1-1/2" Reducing Elbow onto 2" NPT injector. Apply thread sealant to the 1-1/2" NPT nipple. Thread 1-1/2" NPT nipple into 1-1/2" NPT end of reducing elbow. Thread 1-1/2" NPT x 1-1/2" NPT x 3/4" NPT Tee onto 1-1/2" NPT nipple. Tighten pipe fittings until relief valve orientation is correct for your installation and joints are watertight.

   Note: Based on system return piping and access to service boiler, see Figures 1, 13A and 13B, predetermine if injector piping orientation is to be positioned for vertical, horizontal left or horizontal right side return piping as shown in Figure 5.

   Step b. Install relief valve using 3/4" NPT tapping on tee. Relief valve must be installed in vertical position. If orientation of return injector piping is for:

   - 1-1/2" NPT vertical return piping - Install 3/4" NPT x 90° street ell (not furnished) into 3/4" NPT tapping on tee. Install relief valve vertically into street ell. See Figure 5.

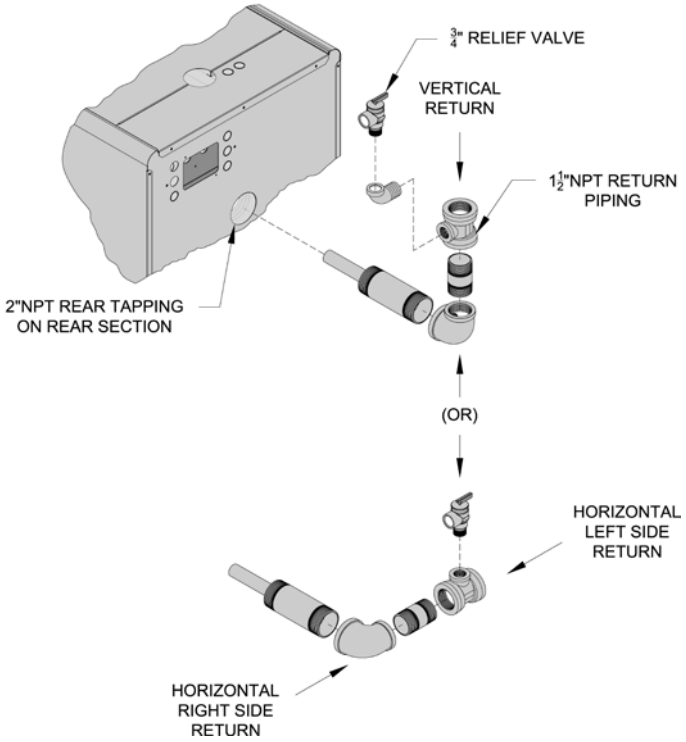


Figure 5: Return Injector Piping and Relief Valve Assembly Details

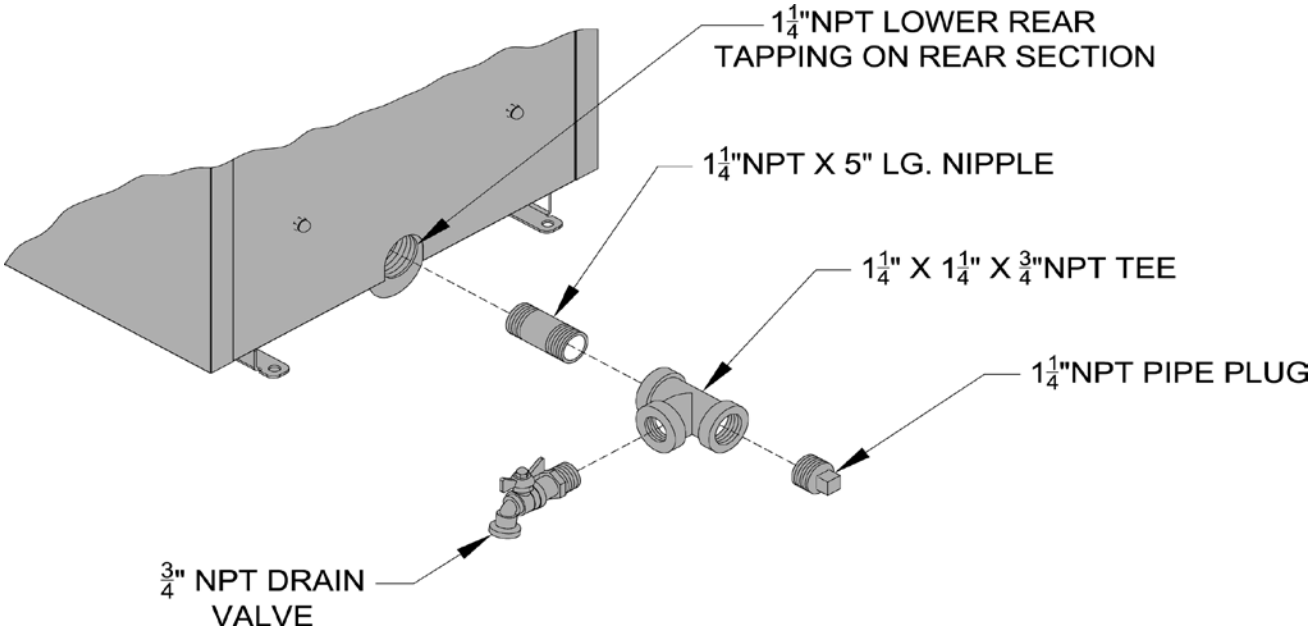


Figure 6: Piping Arrangement for Drain Valve and Indirect Water Heating Return

- 1-1/2" NPT horizontal left or right side return piping - Install relief valve vertically in 3/4" NPT tapping on tee. See Figure 5.

Step c. Pipe discharge of relief valve as shown in Figures 13A and 13B. Installation of the relief valve must be consistent with ANSI/ASME Boiler and Pressure Vessel Code, Section IV.

WARNING

Safety valve discharge piping must be piped near floor to eliminate potential of severe burns. Do not pipe in any area where freezing could occur. Do not install any shut-off valves, plugs or caps.

2. Install drain valve, see Figure 6.

Step a. Apply pipe sealant to both ends of 1-1/4" NPT x 5" lg. nipple. Thread nipple into 1-1/4" NPT lower rear tapping on rear section.

Step b. Thread 1-1/4" x 1-1/4" x 3/4" NPT tee on opposite end of 5" lg. nipple installed in Step a.

NOTE: Based on access for servicing and location of sewer or floor drain, when tightening these fittings, determine if drain valve is to be located on the left or right side.

Tighten nipple and tee into 1-1/4" NPT lower rear tapping on rear section until joints are water tight for desired position.

Step c. Apply sealant to 3/4" NPT thread on drain valve. Thread into 3/4" NPT tapping on side outlet of tee. Use hex nut portion to tighten valve until water tight.

3. Connecting field wiring, refer to Figures 7, 28A thru 28C.

Step a. Locate the black, white and green harness wires labeled "120V Power Supply" inside internal junction box, see Figure 7. Using wire nuts, connect the 120 volt power supply field wires to the harness wires.

Step b. Locate the yellow and white wires labeled "System Circulator" inside internal junction box, see Figure 7. Using wire nuts, connect the 120 volt field wires to the harness wires.

Step c. If applicable, locate the violet and white wires labeled "DHW Circulator" inside internal junction box, see Figure 7. Using wire nuts, connect the 120 volt field wires to the harness wires.

Step d. If applicable, locate the brown wire labeled "DHW Demand" inside internal junction box, see Figure 7. Using wire nut, connect the 120 volt field wire to the harness wire.

Step e. 24V thermostat field wiring will enter through 5/16" snap bushing located on either the right side or left side jacket panel. Connect the 24V wiring from the thermostat to the "T-T" terminals on the Option Control Panel.

Step f. To connect other external devices, refer to the instructions included with these devices.

WARNING

Wire an additional safety limit such as a low water cut-off or temperature limit device, other than an IQ Control device, in series with the 120V circuit used to power the boiler. Do Not alter the boiler's factory wiring when adding additional limit.

4. Installing Boiler-ECOM harness (only used with Honeywell Oil Primary).

   Step a. Locate the black Cat5 harness in the miscellaneous parts carton.

   Step b. Plug RJ45 plug into receptacle on right side panel, see Figure 1.

   Step c. Connect other end of harness into ECOM jack on Oil Primary.

   Step d. Secure harness to right side jacket using the two wire clamps located in miscellaneous parts carton.

5. Installing stainless steel flueway baffles. Baffle requirements differ from model to model, see Table 3.

   NOTE: Read caution statement **before** proceeding.

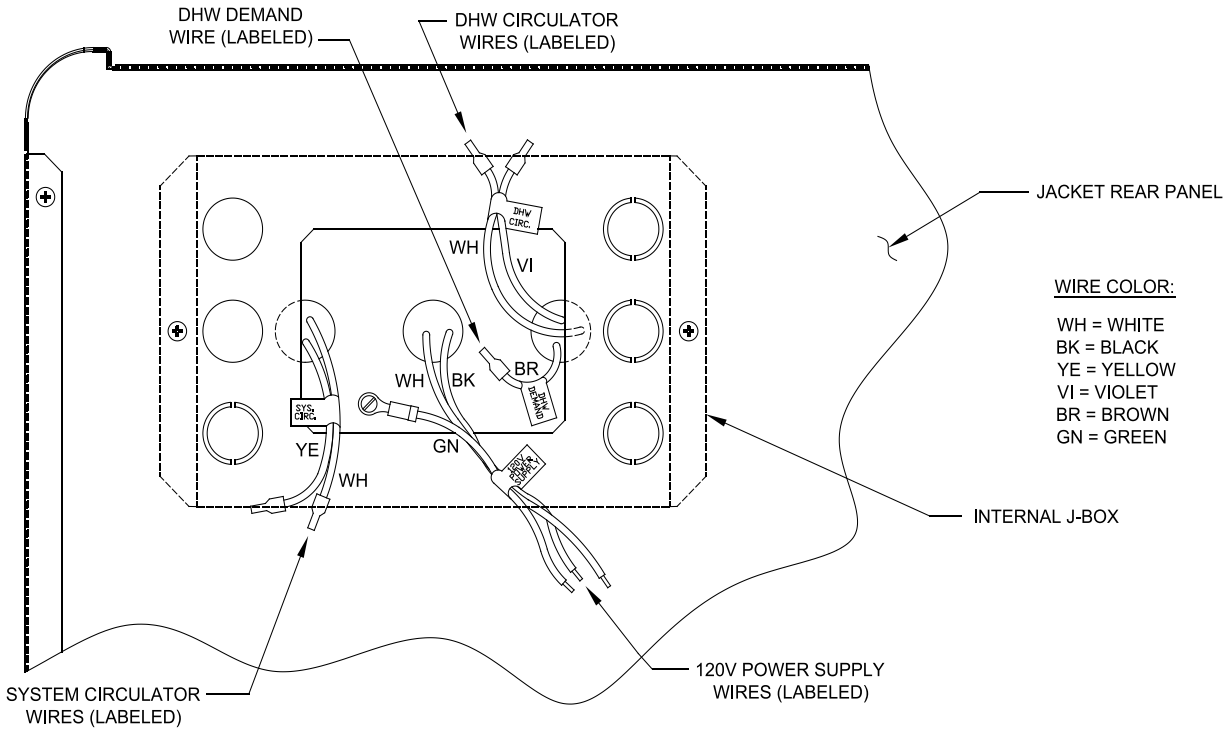
TABLE 3: BAFFLE USAGE

Boiler Model	Baffle Usage	
	2nd Pass	3rd Pass
MPO-IQ84	None	[2] P/N 100081-01
MPO-IQ115	[2] P/N 102066-01	
MPO-IQ147	[2] P/N 100042-01	None
MPO-IQ189		
MPO-IQ231		

CAUTION

These baffles will generate higher efficiencies and lower stack temperatures. Under certain conditions, a lower gross stack temperature entering the chimney has the potential to be cooled below the dew point and create condensate on interior surfaces. Flue gas condensate is corrosive, which requires special consideration and must be addressed immediately.

<u>DO NOT</u> install baffles until you have read Section V, "Venting" completely.



<u>Figure 7: Internal Junction Box and Wiring Harness Details</u>

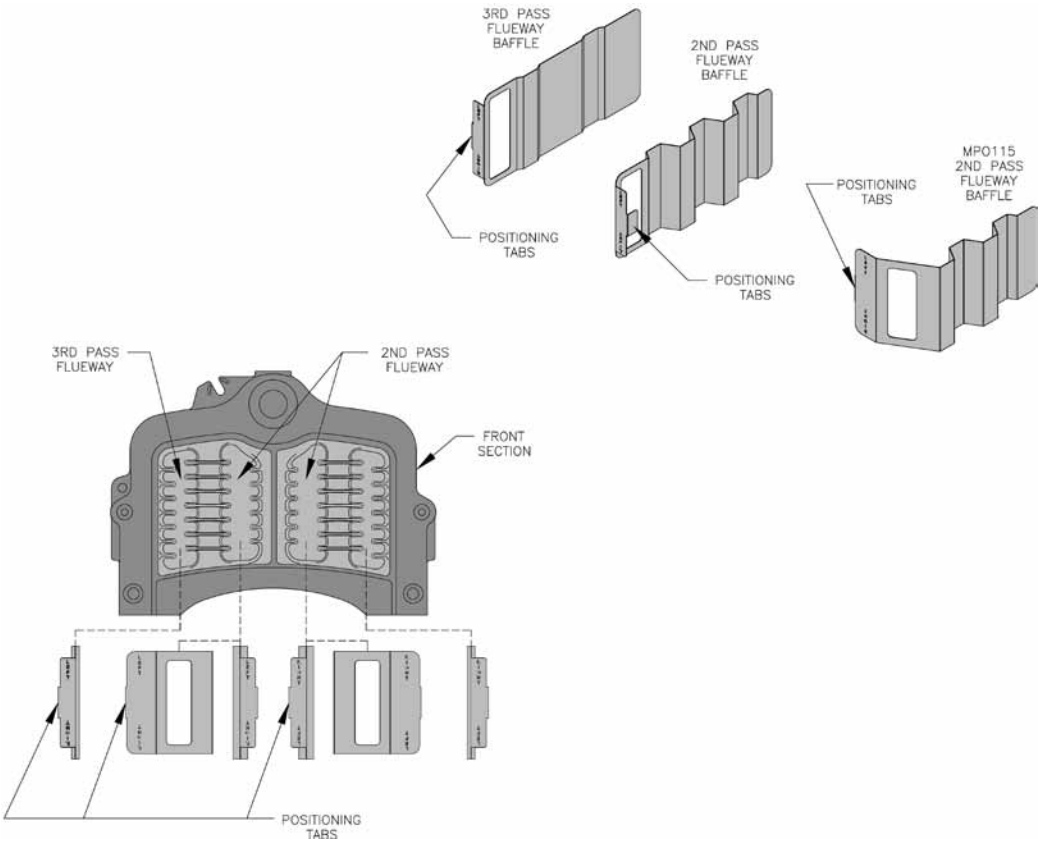


Figure 8: Baffle Orientation in Flueways

Step a. Install stainless steel baffles provided in miscellaneous parts carton as follows, refer to Table 3 and Figure 8:

- Model MPO-IQ84 - To install flueway baffle in 3rd pass on left side of boiler, hold baffle with word "Left" readable at the top. Slide baffle in flueway until position tab touches fins on left side of 3rd pass flueway. To install flueway baffle in 3rd pass flueway on right side of boiler, hold baffle with word "Right" readable at the top. Slide baffle in flueway until position tab touches fins on right side of 3rd pass flueway.
- Model MPO-IQ115 - To install flueway baffle in 3rd pass on left side of boiler, hold baffle with word "Left" readable at the top. Slide baffle in flueway until position tab touches fins on left side of 3rd pass flueway. To install flueway baffle in 3rd pass flueway on right side of boiler, hold baffle with word "Right" readable at the top. Slide baffle in flueway until position tab touches fins on right side of 3rd pass flueway. To install flueway baffle in 2nd pass on left side of boiler, hold baffle with word "Left" readable at the top. Slide baffle in flueway until position tab touches fins on left side of 3rd pass flueway. To install flueway baffle in 2nd pass flueway on right side of boiler, hold baffle with word "Right" readable at the top. Slide baffle in flueway until position tab touches fins on right side of 3rd pass flueway.
- Models MPO-IQ147, MPO-IQ189 and MPO-IQ231 - To install flueway baffle in 2nd pass flueway on left side of boiler, hold baffle with word "Left" readable at the top. Slide baffle in flueway until position tab touches fins on right side of 2nd pass flueway. To install flueway baffle in 2nd pass flueway on right side of boiler, hold baffle with word "Right" readable at the top. Slide baffle in flueway until position tab touches fins on left side of 2nd pass flueway.

NOTE: 2nd and 3rd pass flueway baffle are not interchangeable.

6. **Close the burner swing door** and securely seal the door to the boiler front section by reinstalling the hardware and securing the door using procedure previously outlined in Paragraph D of this section.

NOTICE

When securing burner swing door make sure door is drawn-in equally on both sides.

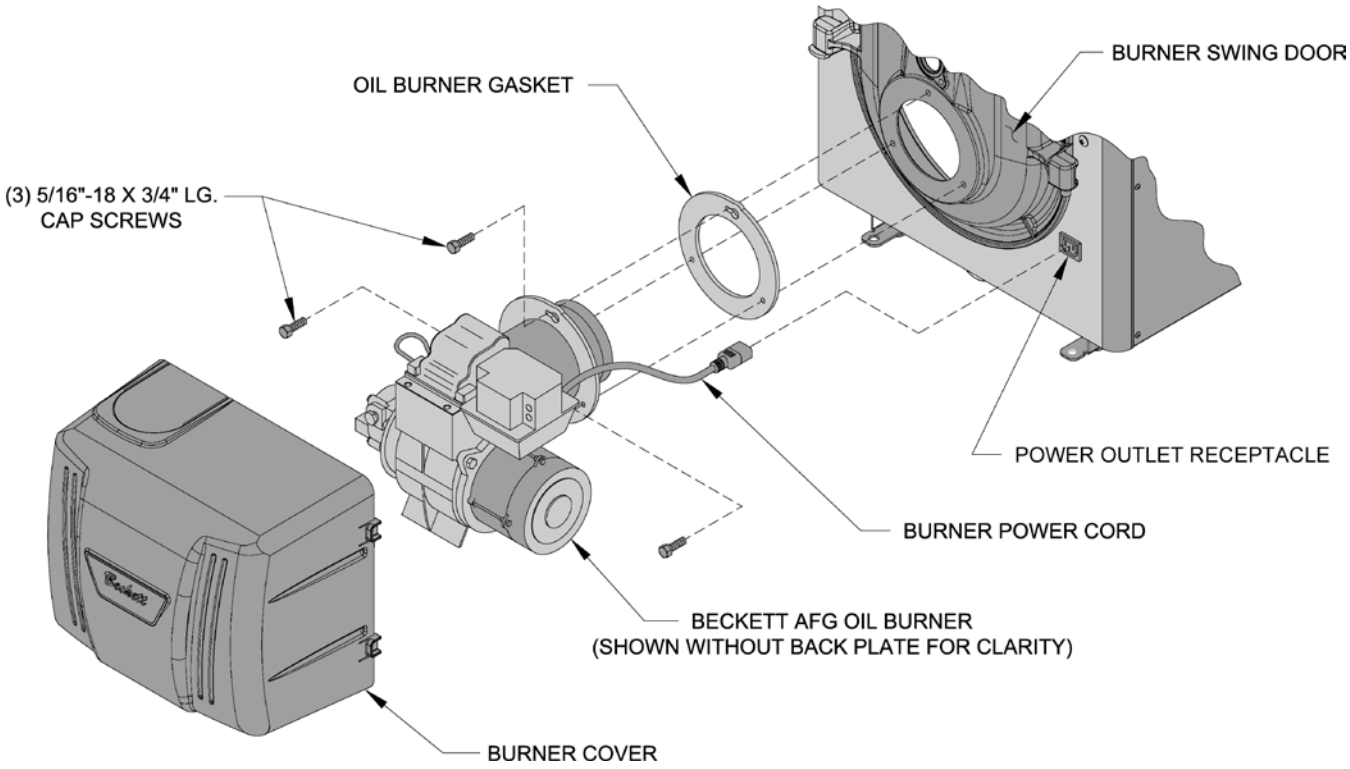


Figure 9: Oil Burner Installation (Beckett shown)

7. **Install oil burner.** (See Figure 9)

Step a. Open burner carton and remove contents.

Step b. Place oil burner gasket on burner and align holes.

CAUTION

Do not install burner without gasket.

Step c. Remove three (3) 5/16-18 x 3/4 lg. cap screw from burner swing door used for mounting burner.

Step d. Thread (1) 5/16-18 x 3/4 lg. cap screw, approximately three (3) full turns, into tapping located at 12:00 o'clock on burner swing door.

Step e. Insert oil burner into the opening of burner swing door. Align and engage keyhole slot in burner flange over head of protruding cap screw installed in previous Step. Rotate burner to the right to lock flange behind head of cap screw.

Step f. Align holes and install two (2) remaining cap screws. Level burner and fully tighten all three (3) screws.

Step g. Plug burner power cord into power outlet receptacle located in lower right corner of front panel.

Step h. Check oil nozzle in burner for size, angle and spray type; inspect electrode settings and head/air plate setting. Refer to Tables 16A thru 16C, 17 and Section IX. Refer to Burner Manufacturer's Manual for detail instructions.

MPO-IQ Unit-Pak Boiler Assembly Shipment (-LLU)

Content Check List (see Figure 10)

1. ___ Cast Iron Section/Burner Swing Door/Smoke Box Assembly Mounted on Shipping Skid:

____ MPO-IQ84/115 – Part # 103071-02 / 100045-01 / 100021-01
____ MPO-IQ147 – Part # 103071-03 / 100045-01 / 100021-01
____ MPO-IQ189 – Part # 103071-04 / 100045-01 / 100021-01
____ MPO-IQ231 – Part # 1030711-05 / 100045-02 / 100021-01

2. ___ Jacket Carton

____ MPO-IQ84/115 – Part # 103069-02
____ MPO-IQ147 – Part # 103069-03
____ MPO-IQ189 – Part # 103069-04
____ MPO-IQ231 – Part # 103069-05

3. ___ Part Carton

____ MPO-IQ84 – Part # 103112-01
____ MPO-IQ115 – Part # 103112-02
____ MPO-IQ147/189 – Part # 103112-03
____ MPO-IQ231 – Part # 103112-05

4. ____ Control Carton

____ Control Assembly
Part # 103857-01
____ Jacket Poly Front Cover
Part # 102600-06
____ MPO-IQ Logo Plate
Part # 102502-04

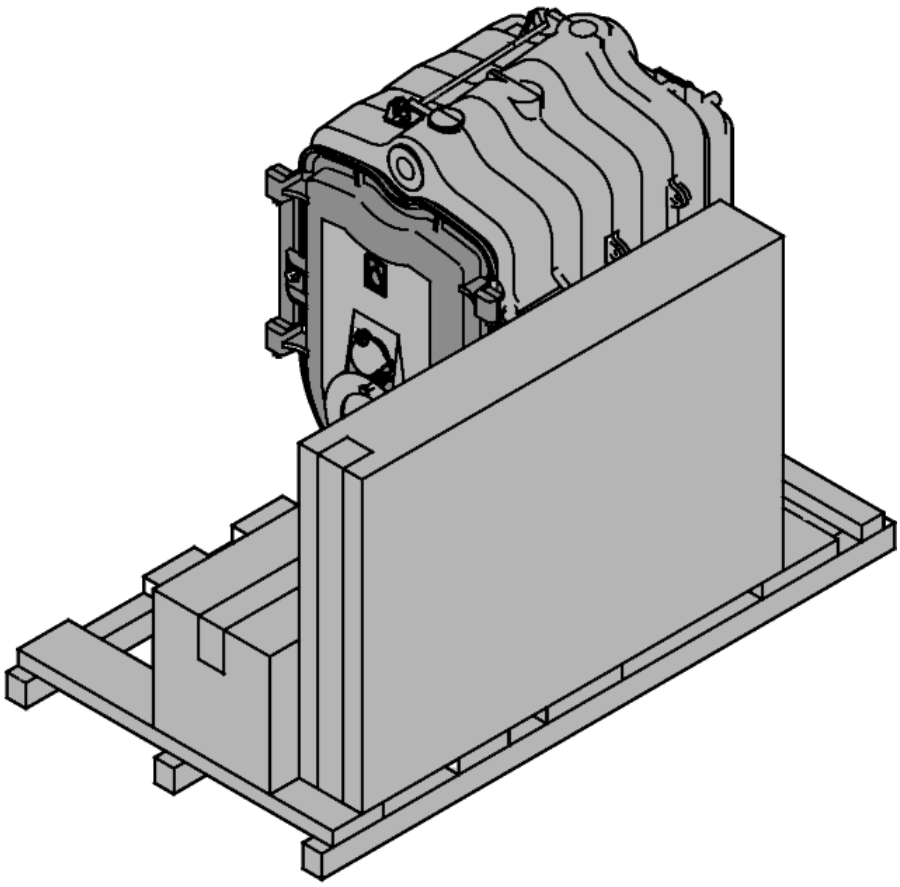


Figure 10: MPO-IQ Unit-Pak Boiler Shipment Contents (outside container removed)

III. UNIT-PAK BOILER ASSEMBLY - TRIM & CONTROLS (continued)

A. REMOVAL OF CAST IRON SECTION/BURNER SWING DOOR / SMOKE BOX ASSEMBLY FROM SKID.

WARNING

The Cast Iron Section/Burner Swing Door/Smoke Box Assembly has a substantial weight. Insure the travel path to permanent location, as well as mounting surface at boiler permanent location, are structurally sound and rated to handle the boiler weight and water content (refer to Table 1A). Otherwise, a potentially hazardous situation could result in death, serious injury and substantial property damage.

1. Move crated Cast Iron Section/Burner Swing Door/ Smoke Box Assembly and part cartons on the shipping skid as close to final permanent location as possible.
2. Remove all fasteners at crate skid. Lift outside container. Examine the skid contents for damage due to shipping and handling.
3. Remove Jacket Carton, Control Carton and Part Carton from skid and set aside.
4. READ AND UNDERSTAND ALL INSTRUCTIONS BEFORE ATTEMPTING BOILER HANDLING AND INSTALLATION.
5. The Cast Iron Section/Burner Swing Door/Smoke Box Assembly is secured to shipping skid with four lag screws. Remove the screws and discard.
6. For manual Cast Iron Section/Burner Swing Door/ Smoke Box Assembly removal prepare one piece of 4" x 4" x 16" lg. (or two pieces of 2" x 4" x 16" lg.) and two pieces of 1" Sch. 40 black pipe to be used as handles.
7. Place wooden block(s) 12" from rear of skid as shown. See Figure 11 " Boiler Removal from Skid".
8. Insert 1" Sch. 40 black pipe handles thru leg holes in front and rear section legs. Center rear pipe ends on wooden block(s). See Figure 11.
9. For best leverage, the pipe handles should extend 48" minimum beyond front section face.
10. Using the pipe handles, lift the Cast Iron Section/Burner Swing Door/Smoke Box Assembly until adjustable legs are elevated above the skid deck boards.
11. Remove the skid from underneath the Cast Iron Section/ Burner Swing Door/Smoke Box Assembly.
12. Lower pipe handles until front adjustable legs touch the floor. Place wood blocks under front legs, if required, before lowering, to provide hand clearance.
13. To lower rear of the Cast Iron Section/Burner Swing Door/Smoke Box Assembly tilt boiler slightly forward by pushing on smokebox, or, lift pipes protruding thru rear legs, until wooden block(s) can be removed (see Figure 11). Slowly allow the weight of boiler to tilt backward until rear legs rest on floor.
14. If wood blocks were placed under front legs, lift pipe handles; remove the blocks and lower front legs to floor. Remove pipe handles.
15. Move Cast Iron Section/Burner Swing Door/Smoke Box Assembly to permanent position by sliding or walking.

CAUTION

Do not drop boiler when removing from skid and moving to permanent position.

B. PROCEDURE TO OPEN, CLOSE AND SECURE BURNER SWING DOOR.

Throughout this manual you will be instructed to open and close Burner Swing Door for various reasons. There is a proper and improper method of closing and securing the door opened for front jacket panel installation, inspection, cleaning or field service. Refer to paragraphs C "Jacket Front Panel Installation", and, E "Closing/Securing Burner Swing Door" for details.

C. IMMERSION WELL INSTALLATION

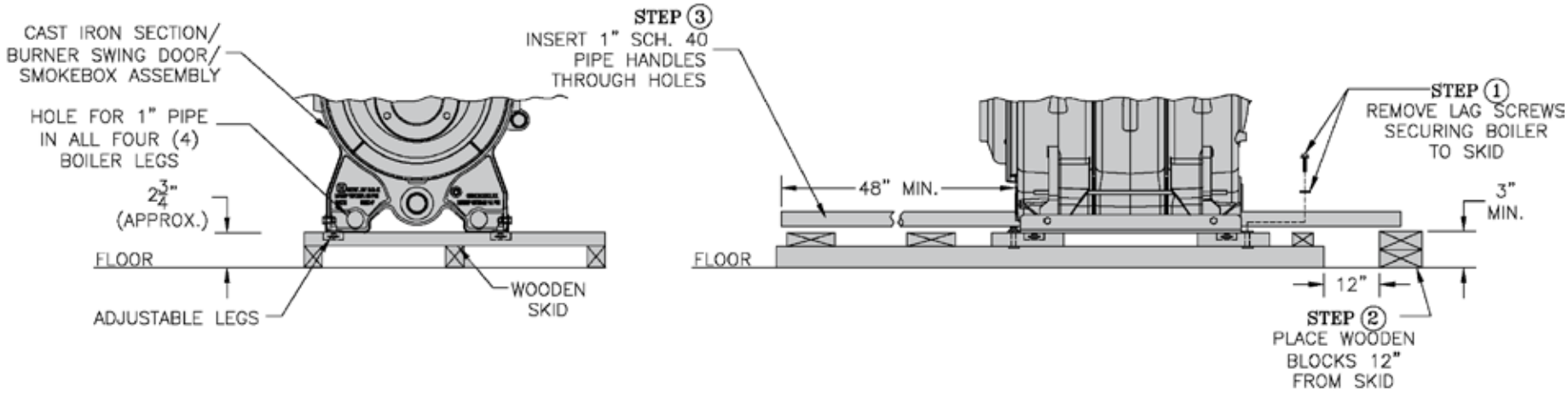
1. Locate immersion well inside Part Carton.
2. Apply thread sealant to ½" NPT male threads.
3. Thread well into ½" NPT boss on top of the front section. Using hex head, tighten well until watertight.

D. JACKET FRONT PANEL INSTALLATION.

In order to install front jacket panel Burner Swing Door and door mounting bracket need to be removed. As shipped, the door would open to the left side.

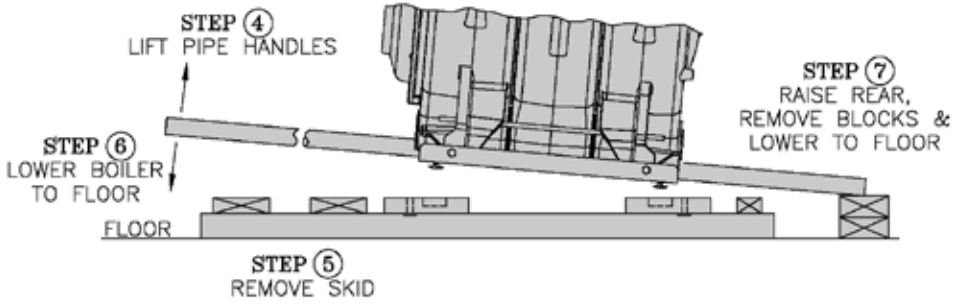
1. To open/remove Burner Swing Door (mounted on Cast Iron Section/Burner Swing Door/Smoke Box Assembly) and door mounting bracket for front jacket panel installation:
   a. Loosen but not remove door left side latching hardware (3/8"-16 x 1-3/4" tap bolt).
   b. Loosen and remove door right side latching hardware (3/8"-16 x 1-3/4" tap bolt and 5/16" washer) and set aside.
   c. Remove door left side latching hardware (3/8"-16 x 1-3/4" tap bolt and 5/16" washer) and set aside.
   d. Lift the door off mounting bracket and set aside.
   e. Remove two 5/16"-18 – ¾" hex head cap screws securing door mounting bracket to front section and set aside.
   f. Remove door mounting bracket and set aside.
   g. Note/mark cap screw bosses on front section left side; locate/mark similar two bosses directly opposite on

III. UNIT-PAK BOILER ASSEMBLY - TRIM & CONTROLS (continued)



PARTIAL FRONT VIEW

PARTIAL SIDE VIEW NO. 1



PARTIAL SIDE VIEW NO. 2

Figure 11: Boiler Removal from Skid

front section right side. These four front section bosses are front jacket panel and door mounting bracket attachment points.

2. Open Jacket Carton and locate jacket front panel (has factory attached 1" fiberglass insulation). See also "Repair Parts" Section, "Jacket Assembly" illustration for part identification.
3. Locate Hardware Bag, remove two 5/16"-18 x ½" Phillips pan head machine screws.
4. Place front jacket panel over front section attachment bosses and align jacket holes with front section boss holes.
5. Firstly, install two 5/16"-18 x ½" Phillips pan head machine screws hand tight to secure front jacket panel right side to casting
6. Secondly, insert 5/16"-18 – ¾" hex head cap screw thru door mounting bracket upper hole and upper hole on left side of front jacket panel simultaneously, and, fasten the bracket and panel to casting hand tight.
7. Thirdly, insert 5/16"-18 – ¾" hex head cap screw thru door mounting bracket lower hole and lower hole on left side of front jacket panel simultaneously, and, fasten the bracket and panel to casting hand tight.
8. Finally, tighten both sets of hardware to secure the bracket and front jacket panel.
9. Inspect fiberglass rope located on the swing door. The rope must be evenly distributed around the perimeter of the door groove and cannot bunch or overhang. Repair or replace, if the rope is damaged, or, there is a gap between the rope ends.
10. Inspect burner swing door insulation for damage and proper type.

    By design, for all models, cast bars on front section between the combustion chamber, and, between the left and right side 2nd and 3rd pass flueways should make an impression in door insulation to seal the chambers.

    By design, door insulation on model MPO-IQ231 **will have** two by-pass pockets cast into the insulation centered on the bar between the combustion chamber and 3rd pass flueways. By design, door insulation on models MPO-IQ84, MPO-IQ115, MPO-IQ147 and MPO-IQ189 **will not have** any by-pass pockets. If insulation is damaged, or, improper type regarding the pockets, it must be replaced.
11. Upon inspection completion, lift door and place integral cast hinge pins into door mounting bracket slotted holes. Do not close and secure door at this time, proceed to installing stainless steel flueway baffles.

E. <u>FLUEWAY BAFFLE INSTALLATION.</u> Refer to Section II, Paragraph F.

F. <u>CLOSING / SECURING BURNER SWING DOOR</u>. Refer to Section II, Paragraph D.

G. <u>JACKET REAR PANEL INSTALLATION</u>.

1. Locate jacket rear panel (has factory attached 3" fiberglass insulation) inside Jacket Carton. See also "Repair Parts" Section, "Jacket Assembly" illustration for part identification.
2. Locate and remove from Hardware Bag rear panel mounting hardware – (2 pcs) 5/16"-18 x 3" lg. tap studs, (2 pcs) 5/16"-18 plated acorn nuts, (2 pcs) 5/8" x 2-9/32" round spacers and (2 pcs) 5/16"-18 x ½" Phillips pan head machine screws.
3. Locate rear panel two lower attachment bosses on rear section.
4. Thread both 5/16"-18 x 3" lg. tap studs, with short threaded end, into lower attachment bosses on rear section.
5. Install both 5/8" x 2-9/32" round spacers over tap studs.
6. Place rear jacket panel over rear section, so both tap studs clear thru lower panel holes, rear section cleanout openings clear thru matching panel cut-outs and brass sample port plug clears panel matching hole.
7. Secure panel bottom to studs with acorn nuts hand tight.
8. Align upper panel attachment holes with smokebox upper attachment bosses and install 5/16"-18 x ½" Phillips pan head machine screws hand tight.
9. Securely tighten rear jacket panel mounting hardware.

H. <u>FLUE CLEANOUT COVERS AND SMOKEBOX COLLAR INSTALLATION.</u>

1. Remove two cast iron Cleanout Covers, cast iron Smokebox Collar and the tube of hi-temperature silicon adhesive sealant from Part Carton. See also "Repair Parts" Section, "Bare Boiler Assembly" illustration for part identification.
2. Check the rope gasket factory attached to the covers. Repair or replace, if the rope is damaged, or, there is a gap between the rope ends.
3. Locate/remove four 5/16"-18 – 7/8" hex head cap screws from Hardware Bag.
4. Apply a drop of supplied Anti-seize (pouch provided in Part Carton) to each of four (4) 5/16"-18 x 7/8" hex head cap screws for rust protection and to facilitate easy removal for future service.

5. Position left Cleanout Cover over rear section cleanout opening, align section boss holes with Cleanout Cover holes, install both 5/16"-18 – 7/8" hex head cap screws hand tight, then, alternately tighten them with open end or socket wrench.
6. Repeat above steps with right Cleanout Cover.
7. Apply the adhesive sealant to the underside of the collar, all around, at the inside corner of the collar outer ring. Insure adhesive bead is complete all around and without gaps.
8. Place the collar over smokebox tongue and align collar integral mounting ear slots with smokebox bosses.
9. Thread-in both 5/16"-18 – 7/8" hex head cap screws hand tight, then, alternately tighten them with open end or socket wrench.

I. INSULATION WRAPPER AND BURNER POWER OUTLET RECEPTACLE INSTALLATION.

1. Insulation Wrapper is packed in the Jacket Carton.
2. Unfold Insulation Wrapper, position it over section assembly centered left to right and align two wrapper upper holes with 2" NPT pipe tappings in front and rear section top.
3. Tuck Insulation Wrapper bottom ends under section assembly, between front and rear section legs.
4. Locate and remove Burner Power Outlet Receptacle from Part Carton.
5. Insure that the receptacle middle prong opening is facing down. Snap the receptacle into front jacket panel.

J. EXTERNAL ELECTRICAL ENCLOSURE MOUNTING.

1. Locate and remove Internal J-Box assembly from Part Carton.
2. Remove two #8 x ½" sheet metal screws and three snap bushings from Hardware Bag.
3. Secure the Internal J-Box with sheet metal screws to the top left corner of the Rear Jacket Panel.
4. Install snap bushings into rear of J-Box.
5. Locate and remove J-Box Cover from Part Carton.
6. Secure J-Box Cover to Rear Jacket Panel with two #8 x ½" sheet metal screws from Hardware Bag.

K. TEMPERATURE / PRESSURE GAUGE.

1. Remove the Temperature / Pressure Gauge from Part Carton.
2. Thread the pressure gauge into 1/4" NPT tapping on the front section. Tighten with wrench applied to the square shank of the gauge.

CAUTION

Do not apply pressure to gauge case, as this may result in inaccurate readings.

L. CONTROL PANEL ASSEMBLY AND HARNESS INSTALLATION.

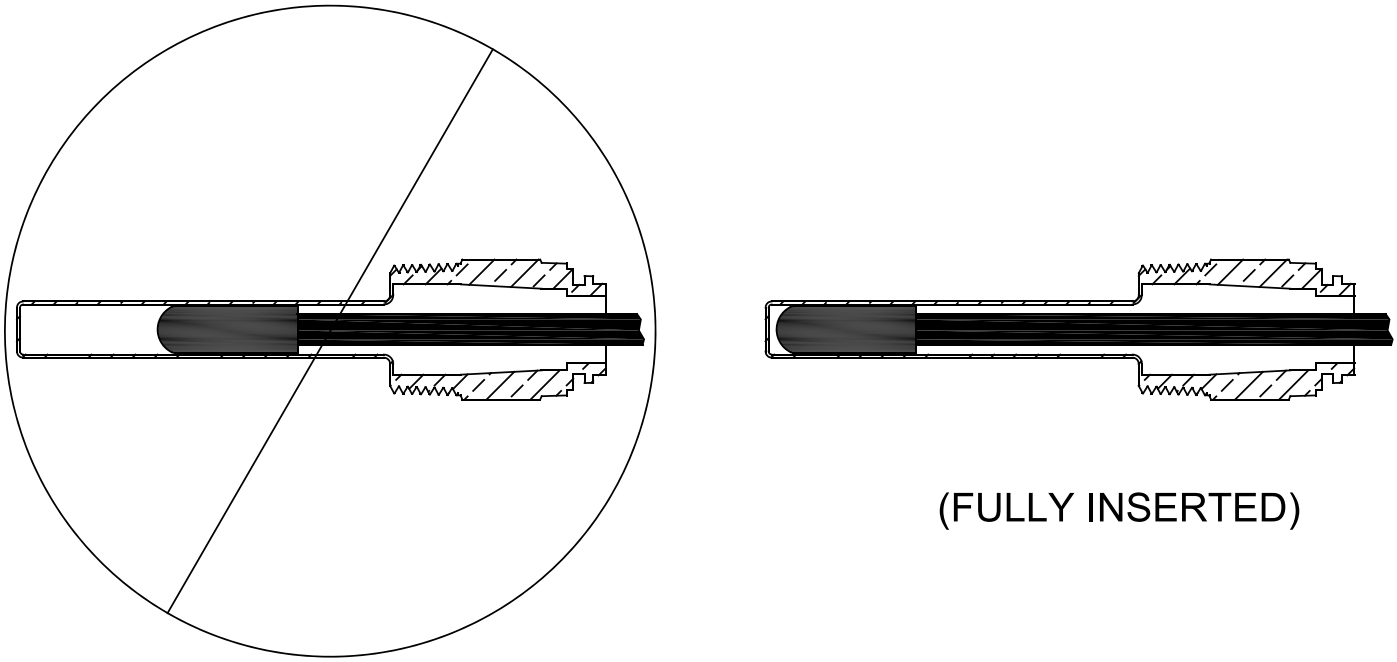
1. Locate and remove the Control Panel Assembly for the Control Carton.
2. Place Control Panel Assembly on top of Insulation Wrapper.
3. Connect the Red, Black and White Burner wires to Burner Power Outlet Receptacle. Refer to Section VII for wire connections.
4. Feed wires labeled "120V Power Supply", "System Circulator", "DHW Circulator" and "DHW Demand" through the three snap bushings at rear of J-Box.
5. Secure Ground Wire Ring terminal to J-Box using the #8-32 x 3/8" screw from the Hardware Bag.
6. Fully insert sensor into immersion well and secure with sensor clip. See Figure 12.
7. Proceed to Paragraph L for completion of Control Panel Assembly installation.

M. SIDE, TOP JACKET PANEL AND PLASTIC COVER INSTALLATION.

1. Locate the Right Side Jacket Panel from Jacket Carton. See also "Repair Parts" Section, "Jacket Assembly" illustration for parts identification.
2. Align right side jacket panel mounting holes with front and rear panel holes.
3. Secure with eight #8 x ½" sheet metal screws from Hardware Bag.
4. Install RJ45 jack into Right Side Jacket Panel.
5. Repeat Steps 1 thru 3 for Left Side Jacket Panel.
6. Secure Control Panel Assembly to side Jacket Panels with eight #8 x ½" sheet metal screws from Hardware Bag.
7. Locate the Top Rear Jacket Panel from Jacket Carton. See also "Repair Parts" Section, "Jacket Assembly" illustration for parts identification.
8. Align top rear jacket panel mounting holes with rear panel holes and secure with three #8 x ½" sheet metal screws from Hardware Bag.
9. Locate the Top Front Jacket Panel from Jacket Carton. See also "Repair Parts" Section, "Jacket Assembly" illustration for parts identification.
10. Align top front jacket panel mounting holes with side panel holes and secure with two #8 x ½" sheet metal screws from Hardware Bag.

11. Locate the Jacket Front Cover from Control Carton. See also "Repair Parts" Section, "Jacket Assembly" illustration for parts identification.
12. Align jacket front cover mounting holes with side panel holes and secure with four #8 x ½" oval sheet metal screws from Hardware Bag.

N. <u>FIELD ASSEMBLY OF BOILER TRIM AND BURNERS.</u> Refer to Section II, Paragraph F.



<u>Figure 12: Immersion Well Probe Insertion</u>

IV. WATER BOILER PIPING

NOTICE

Failure to pipe boiler as specified in this manual may result in excessive system noise.

A. EVALUATE THE EXISTING WATER SYSTEM.

Design a piping system and install boiler which will prevent oxygen contamination of boiler water and frequent water additions.

1. There are many possible causes of oxygen contamination such as:
   a. Addition of excessive make-up water as a result of system leaks.
   b. Absorption through open tanks and fittings.
   c. Oxygen permeable materials in the distribution system.
2. In order to insure long product life, oxygen sources must be eliminated. This can be accomplished by taking the following measures:
   a. Repairing system leaks to eliminate the need for addition of make-up water.
   b. Eliminating open tanks from the system.
   c. Eliminating and/or repairing fittings which allow oxygen absorption.
   d. Use of non-permeable materials in the distribution system.
   e. Isolating the boiler from the system water by installing a heat exchanger.

WARNING

System supply and return piping must be connected to correct boiler piping.

U.S. Boiler Company recommends sizing the system circulator to supply sufficient flow (GPM) to allow a 20°F temperature differential in the system. When sizing the system circulator, the most restrictive single zone should be used to determine maximum pressure drop.

CAUTION

Maintain minimum ½ inch clearance from hot water piping to combustible materials.

3. In order to insure long product life, operate boiler at appropriate flow rate to minimize areas of overheating.
   a. Design system to ensure that the flow is above the limit called for in Table 1.
   b. Maintain a constant boiler pressure of 12 PSI.

WARNING

Do not operate boiler below minimum volumetric flow rates.

TABLE 4: MINIMUM FLOW RATE

Boiler Model No.	Flow Rate (Gal / Min)
MPO-IQ84	4.5
MPO-IQ115	6.0
MPO-IQ147	8.0
MPO-IQ189	10.0
MPO-IQ231	12.0

B. CONNECT SYSTEM SUPPLY AND RETURN PIPING TO BOILER. See Figures 13A and 13B. Also, consult Residential Hydronic Heating Installation and Design I=B=R Guide.

1. If this boiler is used in connection with refrigeration systems, the boiler must be installed so that the chilled medium is piped in parallel with the heating boiler using appropriate valves to prevent the chilled medium from entering the boiler. See Figure 13. Also, consult Residential Hydronic Heating Installation and Design I=B=R Guide.
2. If this boiler is connected to heating coils located in air handling units where they may be exposed to refrigerated air, the boiler piping must be equipped with flow control valves to prevent gravity circulation of boiler water during the operation of the cooling system.
3. If an indirect water heater is used, priority zoning can be used. Do not use priority zoning for Hydro-Air Systems. Refer to the Indirect Water Heater Installation, Operating, and Service Instructions for additional information.
4. The MPO-IQ is designed to withstand thermal shock from return water temperatures as low as 100°F, but prolonged return temperatures of below 135°F can cause excessive flue gas condensation and damage the boiler and/or venting system.

   Use a boiler bypass if the boiler is to be operated in a system which has a large volume or excessive radiation where low boiler water temperatures may be encountered (i.e. converted gravity circulation system, etc.) The bypass should be the same size as the supply and return lines with valves located in the bypass and return line as illustrated in Figures 13A and 13B in order to regulate water flow for maintenance of higher boiler water temperature.

IV. WATER BOILER PIPING (continued)

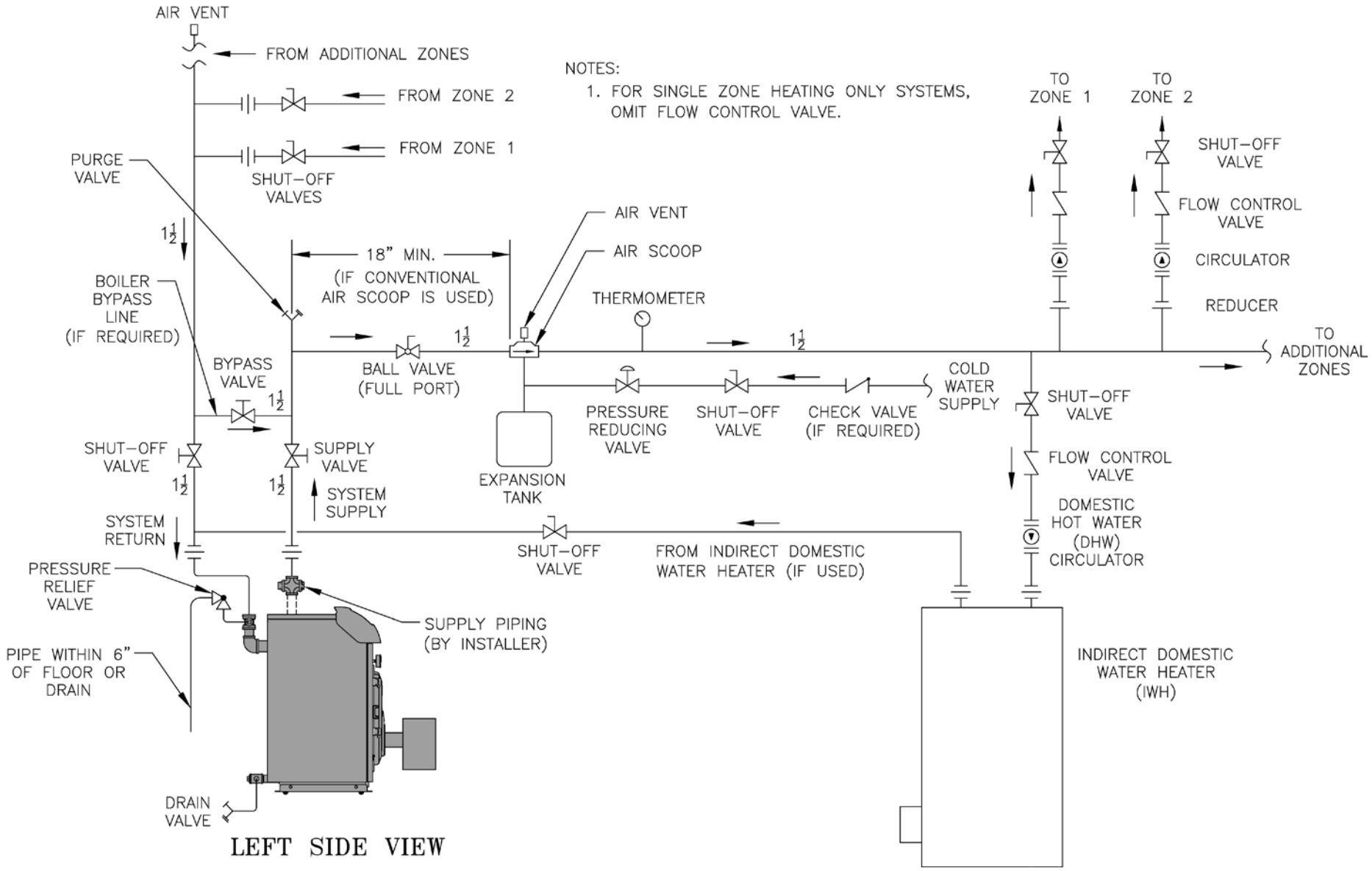


Figure 13A: Recommended Water Piping for Circulator Zoned Heating Systems

IV. WATER BOILER PIPING (continued)

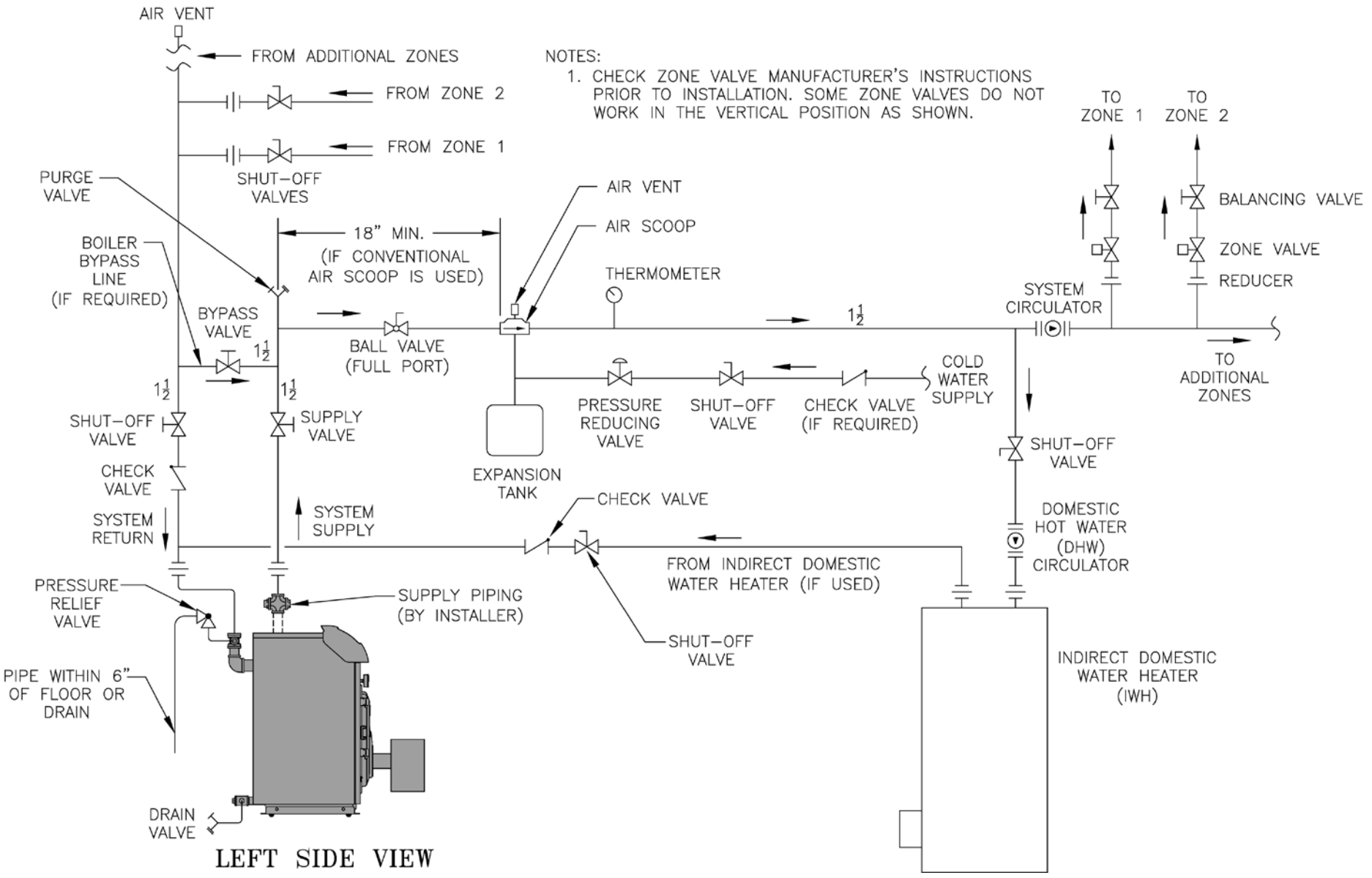


Figure 13B: Recommended Water Piping for Zone Valve Zoned Heating Systems

5. See Figure 14 for suggested near boiler piping of Option Card Controls.

WARNING

The use of a low water cut-off device, while not required unless radiation level is below the boiler, is highly recommended.

If a low water cut-off is required, it must be mounted in the supply piping above the boiler (see Figure 14). The minimum safe water level of a hot water boiler is just above the highest water containing cavity of the boiler; that is, a hot water boiler must be full of water to operate safely.

It is recommended that the LWCO control is installed above the boiler to provide the highest level of protection. However, where the LWCO control is approved by the LWCO control manufacturer for installation in a high boiler tapping of a water boiler, the use of the listed LWCO control is permitted when it is installed according to the LWCO manufacturer's instructions.

6. **If it is required to perform a long term pressure test of the hydronic system**, the boiler should first be isolated to avoid a pressure loss due to the escape of air trapped must first be removed from the boiler.

   To perform a long term pressure test including the boiler, ALL trapped air must first be removed from the boiler.

   A loss of pressure during such a test, with no visible water leakage, is an indication that the boiler contained trapped air.

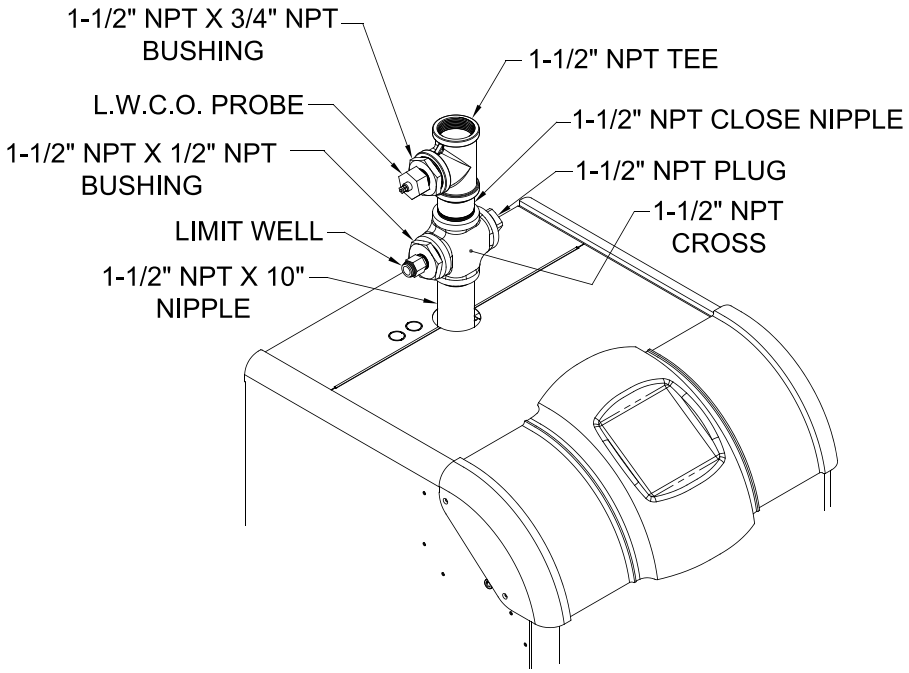


Figure 14: Near Boiler Piping

V. NATURAL DRAFT VENTING (All Boiler Models)

A. CHIMNEY VENTING

1. Chimney venting is an important part of a safe and efficient oil fired appliance system. Contact your local fire and building officials on specific requirements for restrictions and the installation of fuel oil burning equipment. In addition, consult with a professional knowledgeable on the requirements of NFPA 31 – Standard for the Installation of Oil-Burning Equipment and NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances for installations in the United States. Installations in Canada must be reviewed with a professional knowledgeable on the requirements of CSA B139-04 – Installation Code for Oil-burning Equipment.
2. The safe venting of oil fired boilers is dependant on many factors. Some of these factors include:
   a. sufficient draft during the entire heating season to allow for the safe discharge of combustion by-products and;
   b. suitable corrosion protection in the event of condensing flue gases. Only a trained and qualified contractor may install this product.
3. The MPO-IQ can be vented into a fireclay tile-lined masonry chimney that meets requirements outlined in Paragraph 4 below. It can also be vented into a chimney constructed from type L vent or a factory built chimney that complies with the type HT requirements of UL 103. The chimney and vent pipe shall have a sufficient draft at all times, to assure safe proper operation of the boiler. See Figure 15 for recommended installation.

WARNING

Do not de-rate the appliance. Failure to fire the boiler at it's designed input may cause excessive condensation upon the interior walls of the chimney. In addition, the lower input may not create enough draft to adequately evacuate the by-products of combustion.

4. Chimney Inspection – Prior to the installation of any new or replacement fuel burning equipment the chimney shall be inspected by a qualified installer. The chimney shall be inspected for integrity as well as for proper draft and condensate control. Some jurisdictions require the use of a liner when changing fuel types. Some jurisdictions require the use of a liner even when the same fuel is used. At a minimum, the chimney shall be examined by a qualified person in accordance with the requirements of Chapter 11 of NFPA 211, Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances.
   a. Loose Mortar – Loose mortar could be an indication of a prior history of condensing flue gases upon the inside walls of the chimney. Colder climates are more susceptible to this condition. Under no circumstances shall a chimney of this condition be used until it meets the requirements of NFPA 211 or CSA B139-04.
   b. Unlined Chimney – Under no circumstances shall a chimney constructed of brick only be used. Only approved clay liners or listed chimney lining systems shall be used as specified in NFPA 31 or CSA B139-04.
   c. Abandoned Openings – Openings through the chimney wall that are no longer used shall be sealed in accordance to NFPA 211. Often abandoned openings are improperly sealed and usually covered by a gypsum wall covering.
   d. Clean Chimney – Chimney shall be free of all loose debris.
5. Draft Regulator – the draft regulator supplied with the boiler (or equivalent) must be used with this appliance. Refer to Figures 15 and 16.

B. CHIMNEY CONNECTOR

1. A chimney connector (vent pipe) is used to connect the boiler to the base of the chimney. The chimney connector should be kept as short as possible. The horizontal length of the chimney connector shall not be greater than 10 feet.

   NOTE: Secure chimney connector to cast iron smokebox collar with three (3) #10 x ½" self drilling hex head TEK screws provided in miscellaneous parts carton. Locate screws around perimeter of connector as shown in Figure 15 and approximately ½" in from edge. Use drill with 5/16" hex bit to drive screws through connector and smokebox collar.

DANGER

The chimney and connector shall be inspected annually for signs of debris and corrosion. Loose mortar at the base of the chimney may be a sign of condensate damage to the chimney. A chimney professional shall be contacted immediately to examine the damage and recommend a solution. Long term operation while in this condition may cause a venting failure and force flue gases into the living space. If the chimney is to be re-lined use the recommendations in NFPA 31, Appendix E or CSA B139-04.

2. Type B Chimney Connector - a type B chimney connector can be used to transmit the flue gases provided flue gas temperature entering the chimney connector is greater than 310°F.
3. Type L Chimney Connector - a type L vent or other suitable material shall be used for a chimney connector if the temperature or exiting temperature is less than 310°F.

V. NATURAL DRAFT VENTING (continued)

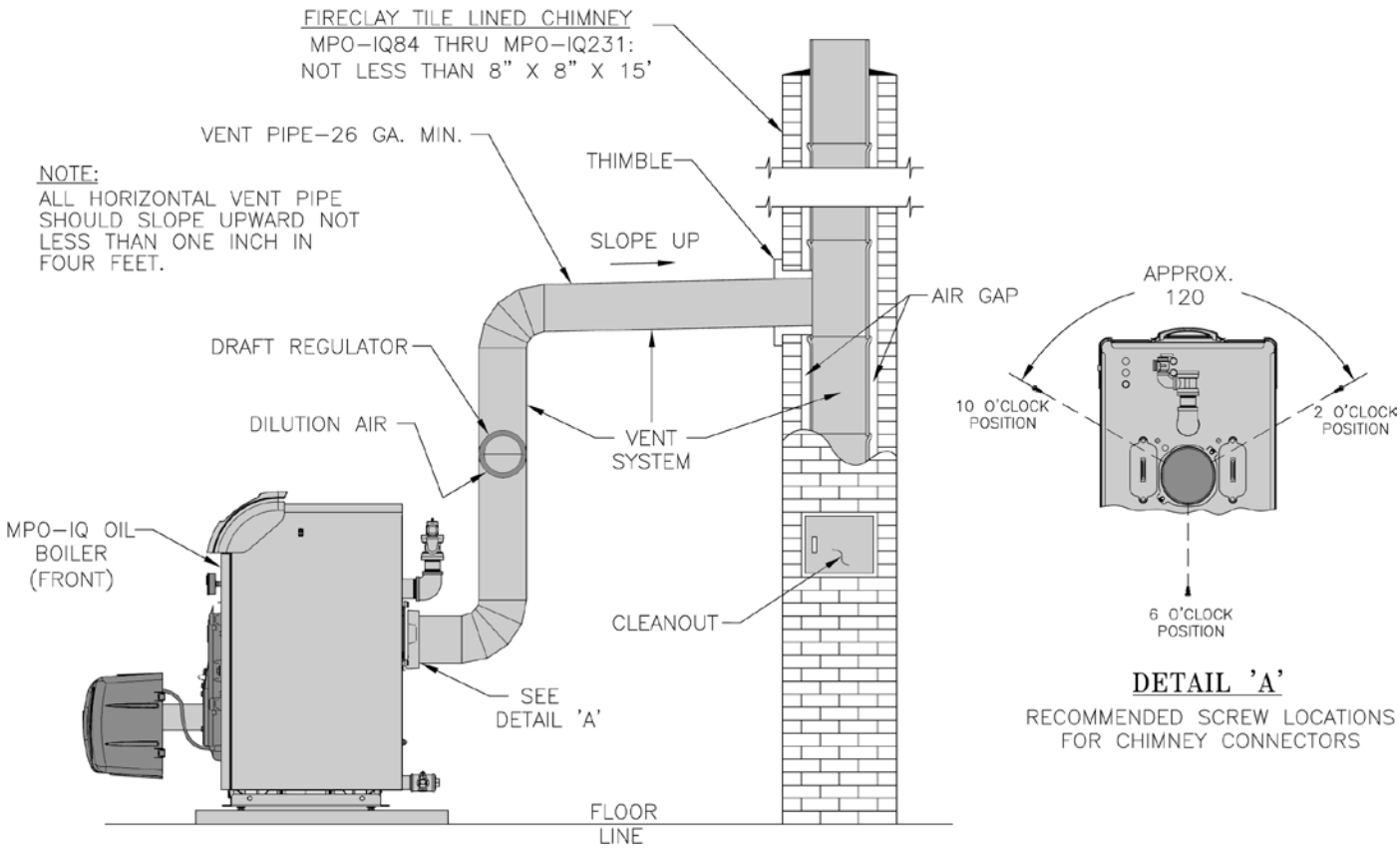


Figure 15: Recommended Vent Pipe Arrangement and Chimney Requirements

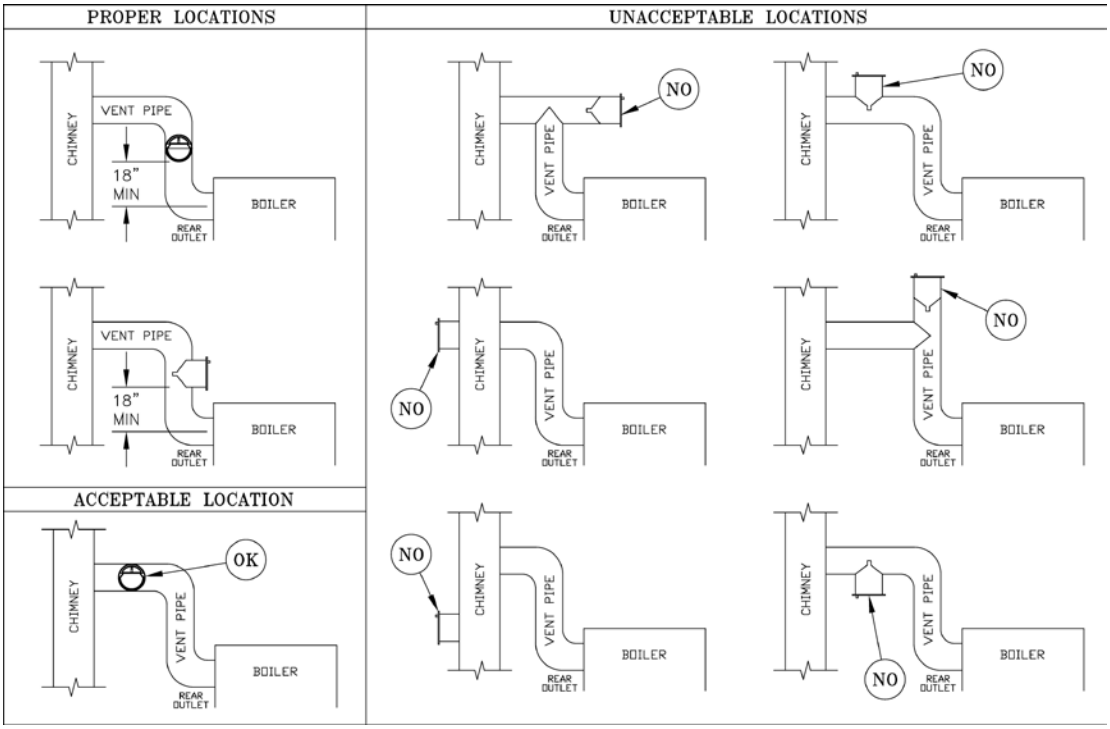


Figure 16: Proper and Improper Locations of Draft Regulator

DANGER

Any signs of condensate seepage at the base of the chimney shall be inspected immediately. The discoloration may be a sign of chimney damage and must be remedied immediately.

C. DRAFT

1. The natural draft generated through a chimney is dependent on several factors including, chimney height, temperature of flue gases, cross section area of chimney, chimney wall insulation value, dilution air and total volume of flue gases, to name a few. Make sure that the boiler has been running for at least 5 minutes before measuring the draft.
2. Minimum Draft at Breech (Canopy) – The draft induced by a chimney must create at least a pressure of 0 (zero) inches water column (" w.c.) at the pressure tapping on the canopy mounted on rear of boiler (see Figure 17). The pressure at the canopy **cannot** be positive since this could create a condition that allows flue gas by-products to escape from the draft regulator. A negative pressure reading up to -.03 inches water column is acceptable for proper operation. (See Tables 16A thru 16C and 17) Burner Specifications at the rear of this manual for more details)
3. Minimum Overfire Pressure – The overfire pressure is another piece of information that is often measured, however this should be done for observation purposes only! The breech pressure must be used to qualify the draft condition. See Tables 16A thru 16C and 17 for more details as a guide. Actual draft and temperature measurements may be different then those values in the table.

D. STACK TEMPERATURE

1. The temperature of the flue gases has a significant effect on the amount of draft created in a vertical chimney as well as the propensity to create condensate. The higher the stack temperature, the greater the amount of draft that can be generated. A lower stack temperature not only reduces the amount of draft that can be created but it also increases the possibility that the flue gases could condense in the chimney connector or stack.
2. NFPA 31 and CSA B139-04 have information to help the installer make an appropriate choice of venting materials. In some cases a chimney may have to be lined to create sufficient draft. In other cases, the chimney may have to be lined to prevent the corrosion of a masonry chimney. Consult with a chimney specialist knowledgeable on the requirements for chimney requirements in your area.

CAUTION

Any doubt on the condition of a chimney or it's ability to prevent the generation and accumulation of flue gas condensate, must be relined according to NFPA 31 (United States) or CSA B139 (Canada).

CAUTION

Use the chimney venting tables as a guide. It is highly recommended that any borderline application should result in the relining of the chimney with a suitable liner that creates sufficient draft and to protect against corrosion caused by flue gas condensate.

3. Baffles – The efficiency of the boiler is based on the insertion of flue baffles supplied with your product. Under no circumstances are other baffles to be used on this product. Refer to Section II, Item F, Paragraph 7 for baffle installation. If there is any doubt on the application of this boiler on the intended chimney, consult with your local code officials. At a minimum, remove the baffles to increase the stack temperature. See Tables 16A thru 16C and 17 for temperature differential (ΔT) with baffles IN and OUT. In addition, the lower the CO_2 level the higher the stack temperature.

WARNING

Remove the baffles if there are any signs of condensation in the chimney or chimney connector. Consult with your local chimney professional for recommendations.

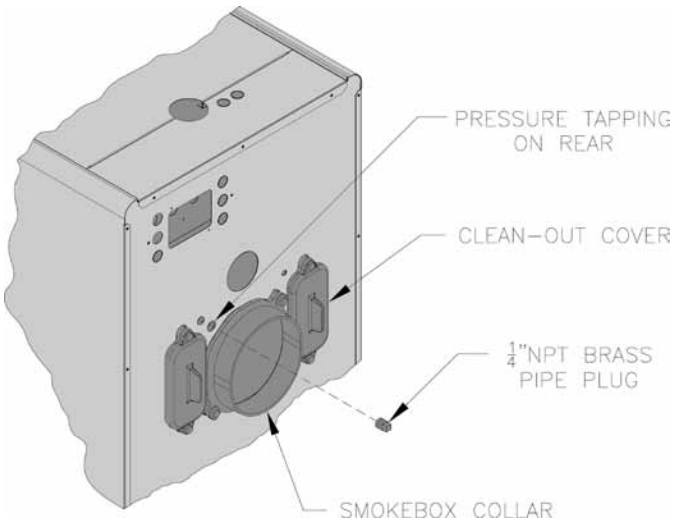


Figure 17: Smokebox Pressure Tapping for Checking Draft at Breech

E. MINIMUM CLEARANCES

See Figure 2A for details regarding clearances to combustibles for the boiler.

F. OPTIONAL AIR INTAKE PIPING INSTALLATION - All air for combustion can be supplied directly to the burner from outdoors providing that the criteria for chimney, vent connector and minimum stack temperature outlined in this section can be maintained. **(ONLY AVAILABLE WITH BECKETT BURNER).** Refer to Section I, Paragraph C, Steps 5 and 6 for optional air intake piping installation information.

WARNING

Using outdoor air in the middle of winter may result in lower stack temperatures and chimney degradation. Any signs of condensate seepage or discoloration at the base of chimney must be remedied immediately per the details outlined in this section.

Do not reduce size of air intake pipe.

Read, understand and follow combustion air instruction restrictions contained in the Pre-Installation Section of this manual.

VI. DIRECT VENTING / AIR INTAKE PIPING (Boiler Models MPO-IQ147 thru 231 ONLY)

A. GENERAL GUIDELINES

1. Direct Vent system must be installed in accordance with these instructions and applicable provisions of local building codes. Contact your local fire and building officials on specific requirements for restrictions and the installation of fuel oil burning equipment. In addition, for boiler installation in United States, consult with a professional knowledgeable on requirements of NFPA 31- Standard for the Installation of Oil-Burning Equipment and NFPA211- Standard for Chimney, Fireplaces, Vents and Solid Fuel-Burning Appliances, latest editions. Installations in Canada must be reviewed with a professional knowledgeable on requirements of CSA B139 – Installation Code for Oil-Burning Equipment, latest edition.
2. In the Direct Vent configuration, all air for combustion is supplied directly to the burner from outdoors, and, flue gases are vented directly outdoors (thru wall), via Direct Vent System (FDVS), which is a non-positive pressure vent system termination for oil-fired appliances, that provides an outlet for products of combustion, and, an intake for combustion air in a single concentric terminal.
3. Direct Vent Hood Assembly minimum clearance to combustible material is 0".
4. Maximum wall thickness that FDVS vent termination may be installed through is 12".

WARNING

This venting system must be installed by a qualified installer (an individual who has been properly trained) or a licensed installer.

DO NOT locate vent termination where exposed to prevailing wind. Moisture and ice may form on surfaces around vent termination. To prevent deterioration, surface must be in good repair (sealed, painted etc.).

DO NOT locate vent termination where petroleum distillates, CFC's, detergents, volatile vapors or any other chemicals are present. Severe boiler corrosion and failure will result.

DO NOT locate vent termination under a deck.

5. Locate the vent terminal so vent pipe is short and direct, and, at the place on exterior wall that complies with the minimum distances as specified in Figure 18 and listed as follows. The vent termination must be located (as measured to the bottom of vent terminal):
   a. Not less than 12" above finished grade or expected snow accumulation line whichever is greater.
   b. Not less than 3 ft above any forced air inlet located within 10 ft.
   c. Not less than 1 ft from any door, window or gravity air inlet.
   d. Not less than 7 ft above grade when located above public walkway.

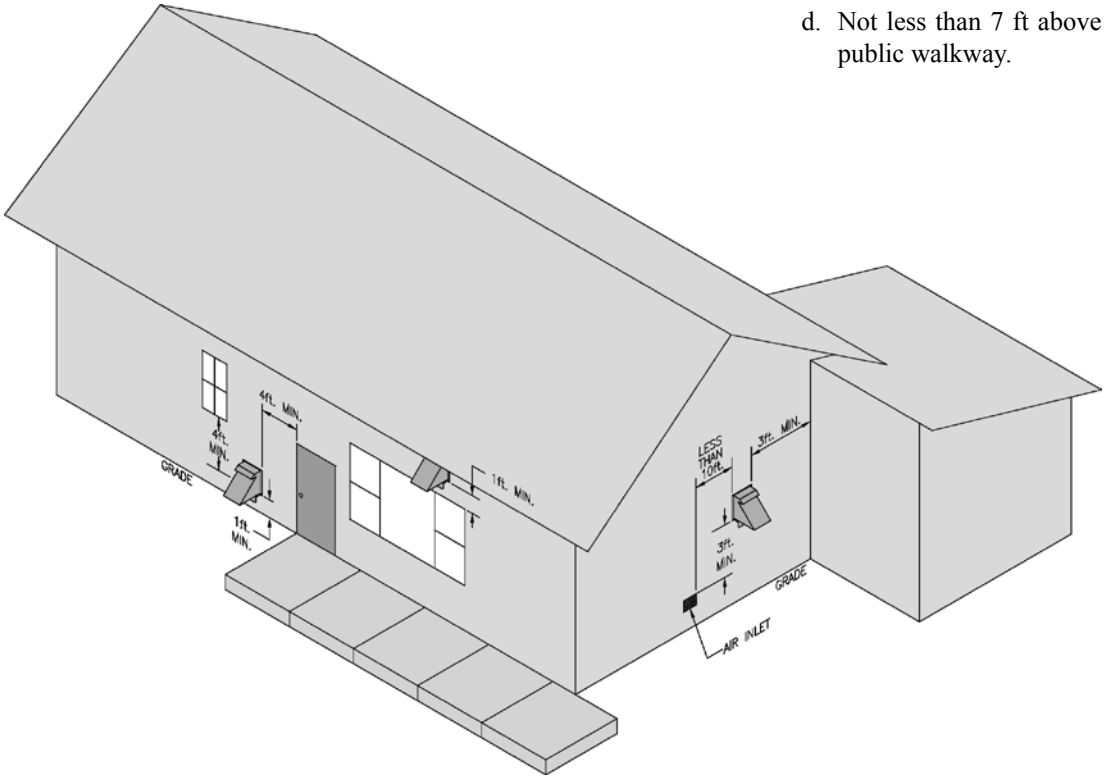


Figure 18: Vent Terminal Location

e. Not less than 3 ft (as measured to side of vent termination) from an inside corner of an L-shaped structure.

f. Not less than 1 ft from the nearest surface of the terminal to a roof soffit.

g. Not directly above, or, not less than 6 ft horizontally from an oil tank vent or gas meter.

h. Not less than 2 ft from nearest surface of terminal to an adjacent building.

B. INSTALLATION OF THE VENT HOOD TERMINAL

1. Inspect Direct Vent Conversion Kit Carton for damage. DO NOT install if any damage is evident.
2. Direct Vent Conversion Kit Carton includes (see Figures 20, 21 and 22):
   - Direct Vent Hood Assembly (consists of Vent Hood Body and Vent Hood Tee) – 1 pc
   - Backing Plate – 1 pc
   - Vacuum Relief Valve VRV-4 – 1 pc
   - Hardware Bag (includes high temperature sealant, fasteners and inner pipe clamps) – 1 pc
   - Appliance (Boiler Flue Outlet) Adapter – 1 pc
   - Appliance Clamp Halves – 2 pcs
   - Cover Sleeve Assemblies – 2 pcs
   - Cover Ring Assemblies – 2 pcs
3. Remove vent system components from carton and set aside.
4. Separate the vent hood tee from the vent hood body and set aside for later use.
5. After determining the location of the venting system termination, cut the square hole in the wall sized according to "L" dimension in Table 5, see Figure 19.
6. Wood or vinyl siding should be cut, so that vent hood base plate mounts directly on the wallboard to provide stable support. If siding thickness exceeds ½", use a spacer bar or board behind the vent hood mounting (base) plate. See Figure 20.
   a. Seal the backside of the vent hood base plate around the outer pipe of the vent hood with a bead of high-temperature silicone sealant (provided in Bagged Hardware).
   b. Mount the vent hood body from outside, through the wall, keeping the outer pipe centered in the hole.
   c. Fasten the vent hood body to the outside wall with appropriate fasteners (installer provided).
   d. Seal the edges of the vent hood base plate to the wall with a high-temperature silicone sealant (provided in Bagged Hardware).
   e. While inside, position the backing plate over the outer pipe and fasten to inside wall with appropriate fasteners (installer provided).

TABLE 5: WALL CUTOUT DIMENSIONS

Boiler Model No.	Direct Vent Conversion Kit Part No.	"L" Dimension (Inch)
MPO-IQ147 MPO-IQ189	102130-02	8¼
MPO-IQ231	1021300-03	9¼

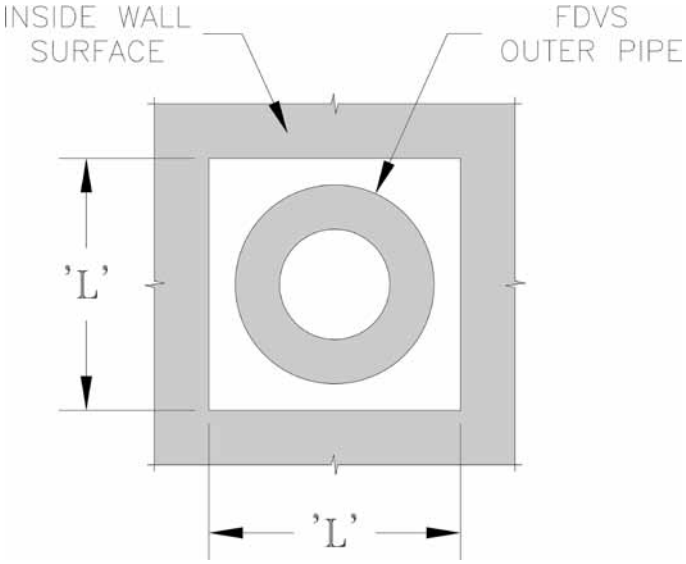


Figure 19: Wall Cutout Dimensions

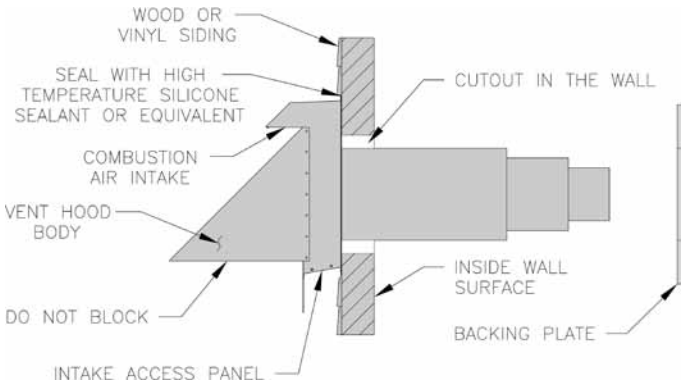


Figure 20: Vent Hood Body Installation

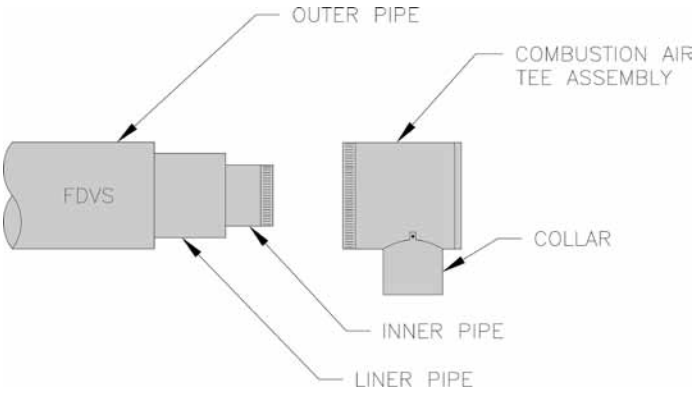


Figure 21: Combustion Air Tee Assembly Installation

C. INSTALLATION OF VENT HOOD TEE

1. Assemble the vent hood tee body to the vent hood outer pipe, and, rotate the tee, so air intake inlet collar is in the desired position. See Figure 21.
2. Attach the vent hood tee body to the vent hood outer pipe with at least tree sheet metal screws (installer provided).

Note: The tee may be rotated into any position so that the collar is in a convenient orientation.

3. After completing assembly of the flexible double wall insulated vent pipe to the vent termination inner pipe (see Figure 22 and the following Steps), apply the supplied high temperature sealant to seal around the inner pipe protrusion thru the vent tee cover pan, around the joint between the vent tee collar and the vent tee body, and, seal or tape the joint between the vent termination outer pipe and the vent tee body.

D. INSTALLING THE FLEX OIL VENT PIPE FROM THE VENT TERMINATION TO THE BOILER FLUE OUTLET

1. The venting system (vent pipe and all connectors) shall be installed in accordance with the applicable provisions of any local codes, and, in United States, requirements of NFPA 31- Standard for the Installation of Oil-Burning Equipment and NFPA211- Standard for Chimney, Fireplaces, Vents and Solid Fuel-Burning Appliances, latest editions. For installations in Canada, follow requirements of CSA B139 – Installation Code for Oil-Burning Equipment, latest edition.
2. A vent pipe connector, designed for positive pressure venting, shall be supported for the design and weight of material employed, to maintain clearances, prevent physical damage and separation of joints. All joints MUST BE sealed, for positive vent pressure, to prevent flue gas leakage into the structure.
3. Support the vent pipe at intervals no greater than three (3) feet apart using perforated metal strap or other non-combustible supports.
4. Allow sealant to cure at least one hour before firing boiler.
5. Route the vent pipe from the vent termination to the boiler using the minimum number of bends possible. The last horizontal section of the vent pipe should have a slight downward slope from the boiler to the vent termination. For clearances to combustible materials refer to Figure 2B.
6. Maximum length of flexible oil vent pipe is 20 ft. The vent pipe is also available pre-cut in 5 ft, 10 ft and 15 ft increments.
7. Verify that flex vent pipe diameter and vent termination inner pipe diameter correspond to a particular direct vent configuration MPO-IQ boiler model (see Table 6).

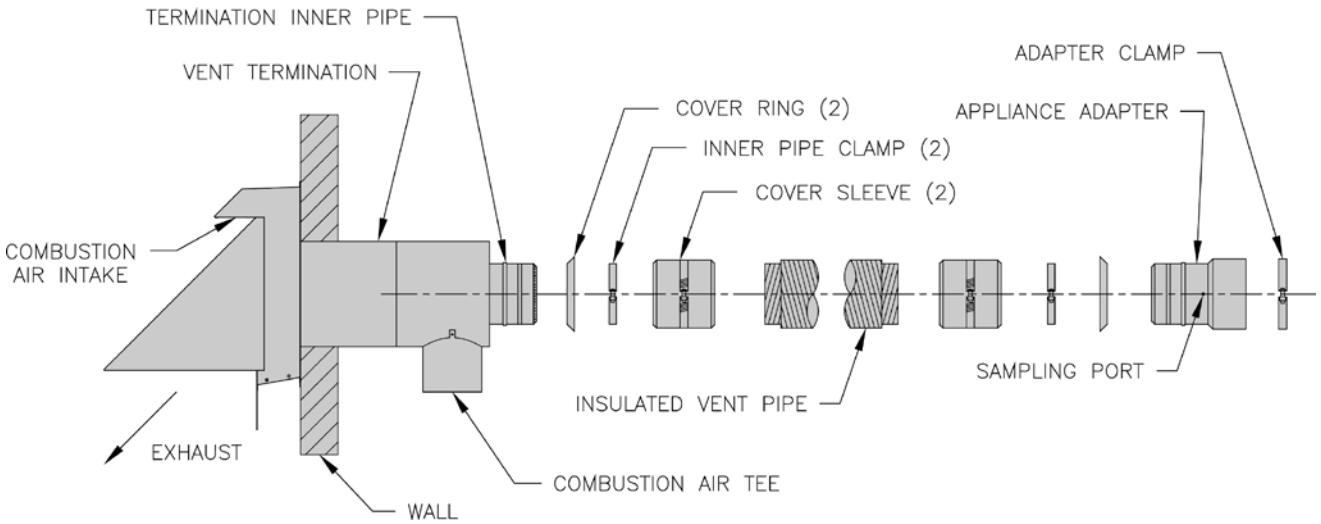


Figure 22: FDVS Component Breakdown

TABLE 6: FLEX VENT / VENT TERMINATION PIPE DIAMETERS

Boiler Model No.	Boiler Flue Outlet Collar OD (Inch)	Vent Hood Inner Pipe Diameter (Inch)	Flex Oil Vent Pipe Inner Pipe Diameter (Inch)	* Flue Outlet Collar to Vent Pipe Adapter (Inch)
MPO-IQ147	6	5		6 to 5
MPO-IQ189				
MPO-IQ231	7	6		7 to 6

NOTE: * The model specific Direct Vent (FDVS) Kit Cartons contain adapters (reducers) (see Table 6) to connect boiler flue outlet collar to vent pipe.

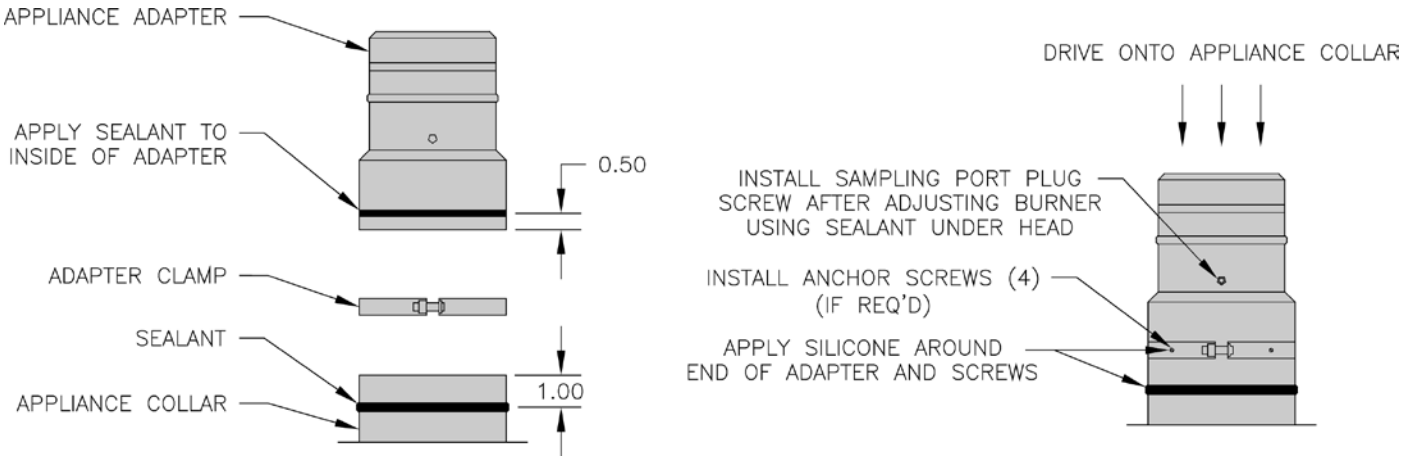

APPLIANCE ADAPTER
APPLY SEALANT TO INSIDE OF ADAPTER
0.50
ADAPTER CLAMP
SEALANT
APPLIANCE COLLAR
1.00
DRIVE ONTO APPLIANCE COLLAR
INSTALL SAMPLING PORT PLUG SCREW AFTER ADJUSTING BURNER USING SEALANT UNDER HEAD
INSTALL ANCHOR SCREWS (4) (IF REQ'D)
APPLY SILICONE AROUND END OF ADAPTER AND SCREWS

Figure 23: Appliance Adapter Installation

E. CONNECTING APPLIANCE ADAPTER TO BOILER FLUE OUTLET COLLAR
(See Figure 23)

1. Apply a bead of supplied high temperature sealant to boiler flue outlet collar approximately 1" from collar end.
2. Remove any oil and grease from inside of supplied Appliance (Boiler Flue Outlet) Adapter, and, apply a bead of high temperature sealant to inside of the adapter, ½" from end.
3. With twisting motion, assemble the appliance adapter onto boiler flue outlet collar.
4. Using a mallet and a block of wood, carefully tap the adapter onto the outlet collar. Insure no damage is done to the adapter and the flue outlet collar.
5. Assemble supplied adapter clamp halves with 5/16-18 bolts and square nuts; install the adapter clamp onto the appliance adapter and tighten securely.
6. If required, install anchoring screws (installer provided) thru four holes in the clamp into the flue outlet collar.
7. Apply sealant around the adapter end mated to the flue outlet collar.
8. Install supplied 3/8" sampling port plug screw hand tight into the adapter sampling port.
9. **After initial boiler start-up and burner testing/ adjustment are completed,** apply high temperature sealant under the head of sampling port plug screw, and, install the screw in the sampling port tightening securely.

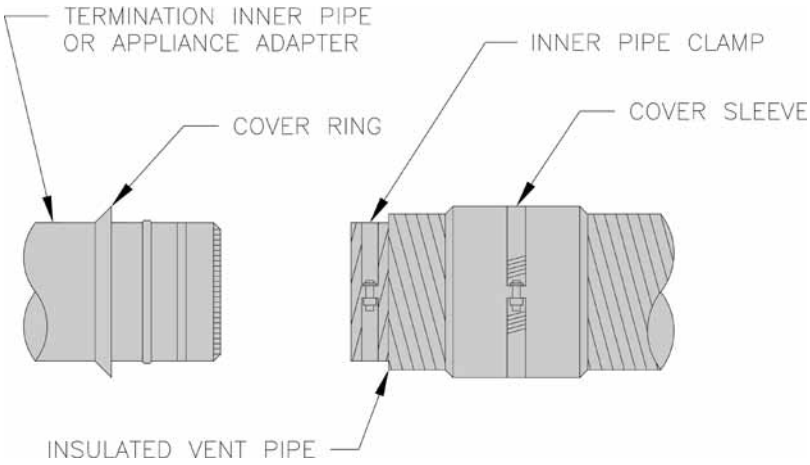


Figure 24: Vent Pipe Assembly to Vent Termination Inner Pipe and Appliance Adapter

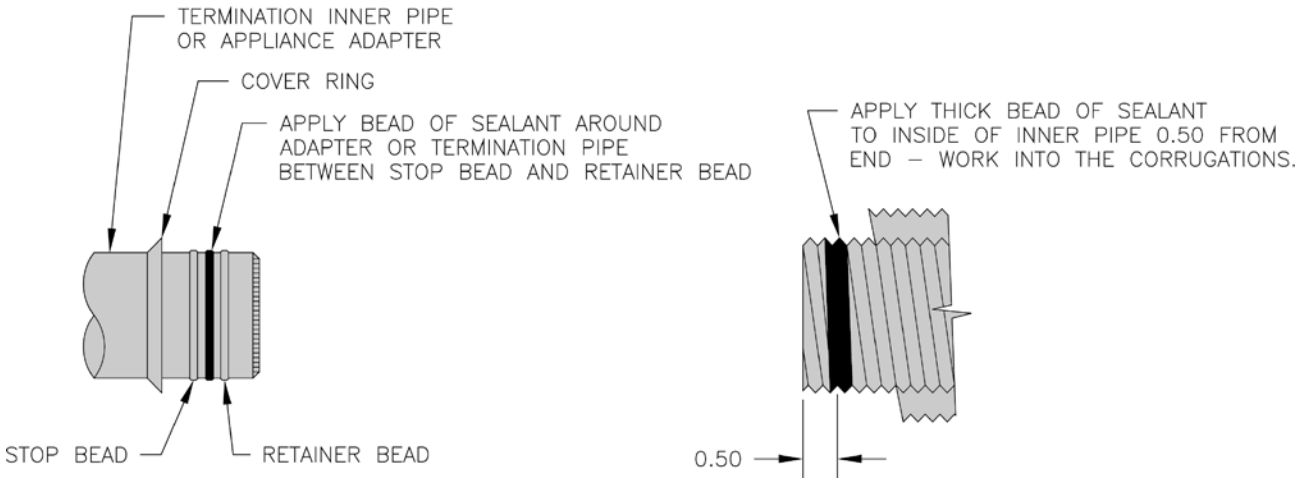


Figure 25: Vent Pipe Ends, Vent Termination and Appliance Adapter Sealing

F. CONNECTING FLEX OIL VENT PIPE TO APPLIANCE ADAPTER AND DIRECT VENT TERMINATION

1. Flexible double wall oil vent pipe is available pre-cut from 5 ft to 20 ft long. If necessary, the vent pipe may be cut to required length with a hacksaw or cutoff saw.

CAUTION

Use safety glasses and other appropriated safety gear when cutting the vent pipe.

2. The double wall flexible vent pipe consists of the smaller inner corrugated stainless steel pipe and larger corrugated aluminum pipe, separated by fiberglass insulation layer.

CAUTION

The inner and outer pipe ends may have sharp burrs. Use gloves, while handling, compressing or expanding the vent pipe.

3. Pull outer vent pipe back 1” to 2” from end of inner vent pipe and remove insulation; firstly, at vent pipe side to be connected to the vent termination; secondly, at vent pipe side to be connected to the appliance adapter. See Figure 24.
4. Install supplied Cover Sleeve Assembly onto each end of outer vent pipe, and, move the assembly a few inches back from the end; firstly, at vent pipe side to be connected to the vent termination; secondly, at vent pipe side to be connected to the appliance (boiler outlet collar) adapter. See Figure 24.
5. Slide supplied Cover Rings; firstly, over stop bead on vent termination inner pipe; secondly, over stop bead on appliance adapter. See Figure 24.
6. Remove any oil and grease from the end of vent termination inner pipe, and, from the end of the appliance adapter.
7. Apply sealant; firstly, between the stop bead and retainer bead at the end of the vent termination inner pipe; secondly, between the stop bead and retainer bead at the end of the appliance adapter. See Figure 25.
8. Assemble supplied inner pipe clamp halves with 1/4-20 bolts and square nuts; position the inner pipe clamps ¼” from the end of inner vent pipe, on vent pipe opposite ends.
9. Remove any oil and grease from inside of each end of the inner vent pipe.
10. Apply a thick bead of sealant to inside of each end of the inner vent pipe, ½” from pipe end, working the sealant into the inner vent pipe corrugations. See Figure 25.
11. Firstly, push one end of the inner vent pipe onto the vent termination inner pipe, all the way up to the stop bead. Secondly, push the opposite end of the inner vent pipe onto the appliance adapter, all the way up to the stop bead.
12. Tighten the inner pipe clamp bolts at both vent pipe ends, until clamp halves are within 1/8” apart. See Figure 26.
13. Starting with vent termination end, slide the cover sleeve assembly and the cover ring together to engage the ring in the groove of the sleeve, then, tighten the built-in cover sleeve clamp. Repeat above steps at the boiler end. See Figure 26.
14. If the appliance collar is within less than 18" of combustible material, wrap minimum 1-1/2" thick fiberglass insulation (installer provided).
15. To maintain vent pipe 1" clearance to combustible material, wrap minimum 1-1/2" thick fiberglass insulation (installer provided) around the exposed portion of the vent termination inner pipe and secure with adhesive-backed aluminum foil tape (installer provided).

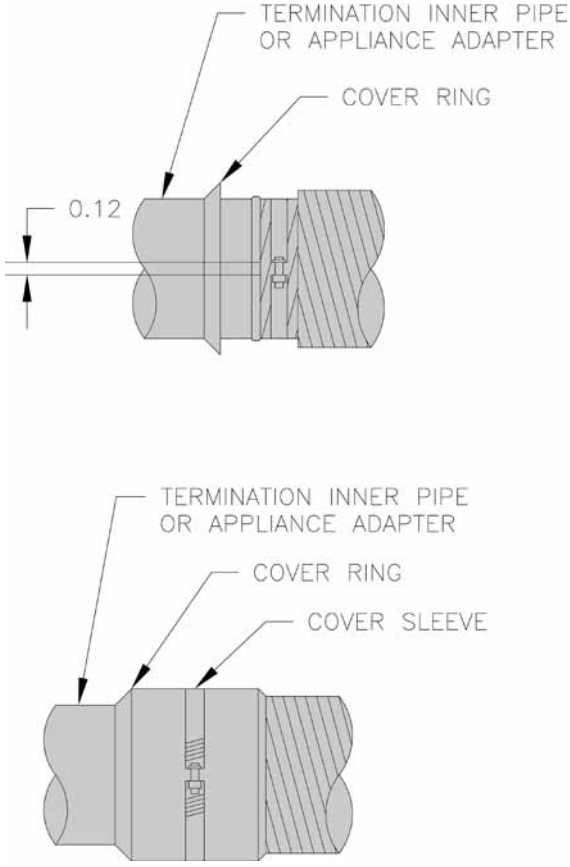


Figure 26: Vent Pipe Assembly to Vent Termination Inner Pipe & Appliance Adapter

G. INSTALLING THE AIR INTAKE PIPING FROM DIRECT VENT TERMINATION TO BURNER OUTSIDE AIR ADAPTER

1. Use 4" diameter galvanized single wall vent pipe and fittings, available at most heating distributors, to connect burner outside air adapter to Direct Vent Termination air intake collar.
2. Maximum air intake pipe length is 40 equivalent feet.

WARNING

DO NOT reduce size of air intake pipe.

3. Start at burner and work towards Direct Vent termination air intake.
4. Remove burner cover. Loosen two screws securing outside air duct bracket to burner cover mounting plate. See Figure 27.
5. Procure a 2-ft section of 4" diameter galvanized single wall vent pipe, cut off the crimped pipe end below stop bead.
6. Insert one end of the vent pipe thru the outside air duct bracket opening and firmly push onto the outside air adapter collar.
7. Secure the pipe to collar with at least (3) sheet metal screws (installer provided) evenly spaced around the collar.

NOTICE

It is essential to ensure reliable operation that combustion air joints are air tight and that VRV is located as close to the burner as possible.

8. Re-tighten the screws securing outside air duct bracket to burner cover mounting plate.
9. Install supplied vacuum relief valve tee assembly, crimped end down, into the opposite end of vent pipe.
10. Secure the tee to the pipe with at least (3) sheet metal screws (installer provided) evenly spaced.
11. Remove the vacuum relief valve gate assembly from the tee.

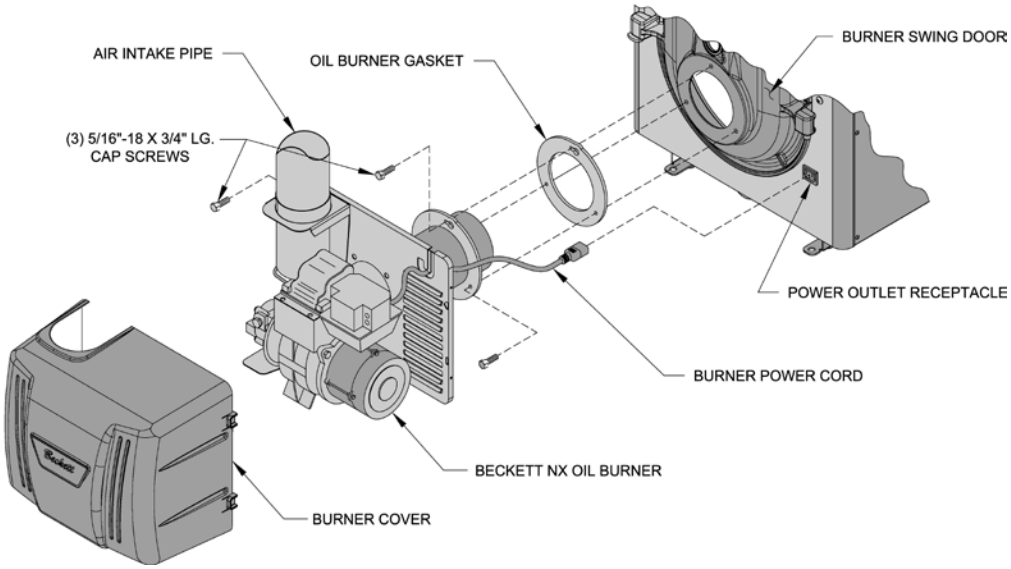


Figure 27: Oil Burner Installation (Beckett shown)

VI. DIRECT VENTING / AIR INTAKE PIPING (continued)

12. Assemble the vacuum relief valve balance weight onto the gate. Refer to the vacuum relief valve manufacturer's instructions for details.
13. Mount the assembled vacuum relief valve gate with balance weight into the tee and fasten with a screw and nut in collar tabs. To insure proper operation, the gate must be level across the pivot point and plumb. Refer to the vacuum relief valve manufacturer's instructions for details.
14. Install remainder of air intake piping to Direct Vent Termination air intake collar, securing each joint with at least (3) sheet metal screws (installer provided) evenly spaced.
15. Maintain ¼" per foot slope in horizontal run to air intake of Direct Vent Termination.
16. Support the air intake piping, as required, using perforated metal strap or other supports.
17. Refer to Burner Manufacturer's Manual for addition information.

VII. ELECTRICAL

DANGER

Positively assure all electrical connections are unpowered before attempting installation or service of electrical components or connections of the boiler or building. Lock out all electrical boxes with padlock once power is turned off.

WARNING

Failure to properly wire electrical connections to the boiler may result in serious physical harm.

Electrical power may be from more than one source. Make sure all power is off before attempting any electrical work.

Each boiler must be protected with a properly sized fused disconnect.

Never jump out or make inoperative any safety or operating controls.

A. GENERAL

1. Install wiring and electrically ground boiler in accordance with requirements of the authority having jurisdiction, or in absence of such requirements the National Electrical Code, ANSI/NFPA 70, and/or the CSA C22.1 Electric Code.
2. Refer to National Electric Code or Local Electric Codes for proper size and type of wire required. Follow Code.
3. A separate electrical circuit must be run from the main electrical service with an over-current device/ disconnect in the circuit. A 15 amp circuit breaker is recommended. A service switch is recommended and may be required by some local jurisdictions.
4. Use anti-short bushings on all wiring passing through boiler jacket, junction boxes and/or control boxes.
5. Use armored cable (BX) over all exposed line voltage wiring.
6. Wiring should conform to Figures 28A thru 28C.

B. INSTALL A ROOM THERMOSTAT on an inside wall about four feet above floor. Never install thermostat on an outside wall or where it will be influenced by drafts, hot or cold water pipes, lighting fixtures, television, rays of the sun or near a fireplace. Keep large furniture away from thermostat so there will be free movement of room air around this control.

Heat Anticipator in Thermostat should be set to .1 amps. If system tends to overheat above the thermostat's temperature setting, reduce heat anticipator setting by .1 or .2 amps. If system tends to short cycle without reaching desired room temperature, increase heat anticipator setting by .1 or .2 amps.

WARNING

The maximum allowable current for each circulator is 5 amps at 120V AC. For circulators with higher amp ratings, you must install a circulator relay or starter coil to provide line voltage to the circulator and connect only the relay or starter coil to boiler terminals. The combined boiler and circulator amperage must not exceed 15 amps.

Install over-current protection in accordance with authority having jurisdiction or, in the absence of such requirements, follow the National Electric Code, NFPA 70, and/or CSA C22.1 Electrical Code. Do not provide over-current protection greater than 15 amperes.

VII. ELECTRICAL (continued)

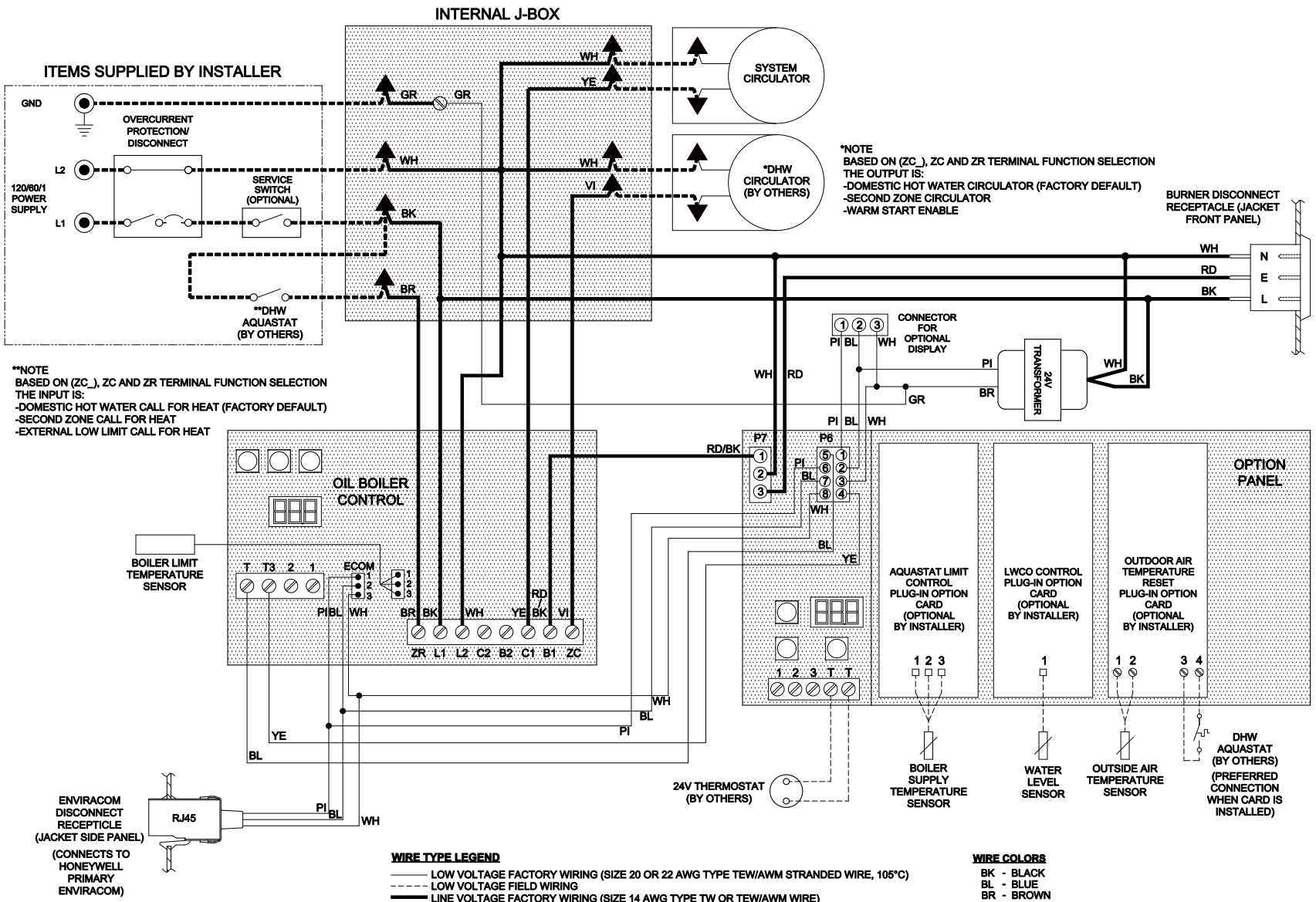
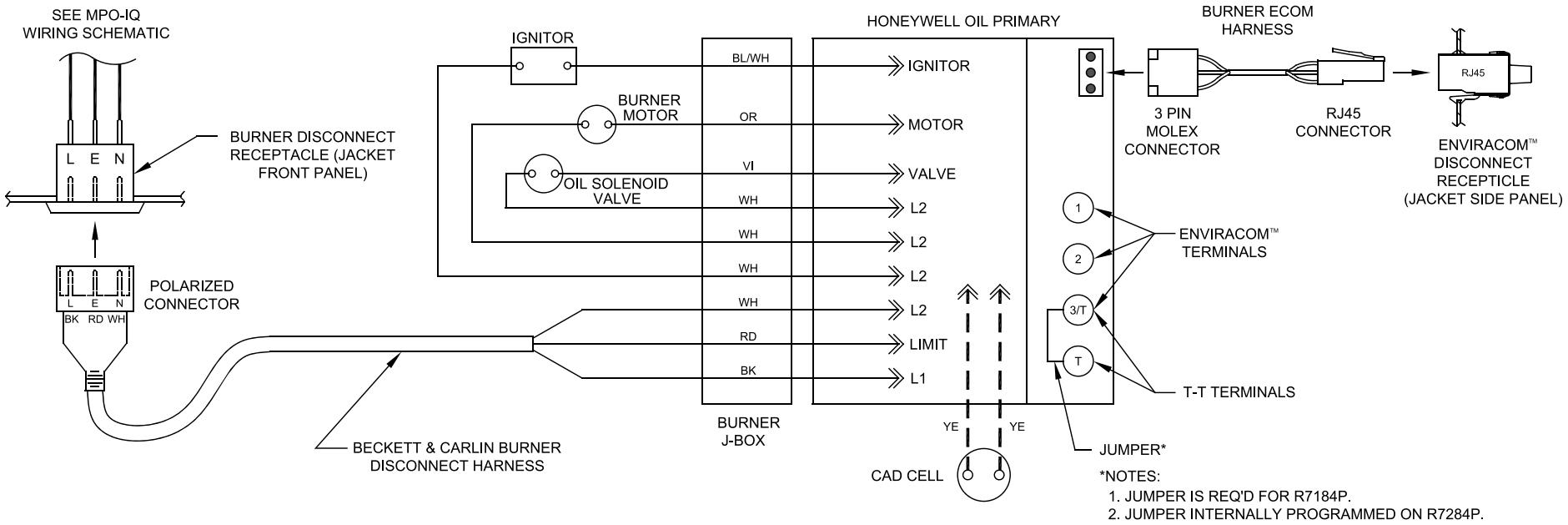

INTERNAL J-BOX
ITEMS SUPPLIED BY INSTALLER
GND
OVERCURRENT PROTECTION/ DISCONNECT
L2
120/60/1 POWER SUPPLY
L1
SERVICE SWITCH (OPTIONAL)
**DHW AQUASTAT (BY OTHERS)
SYSTEM CIRCULATOR
*DHW CIRCULATOR (BY OTHERS)
*NOTE
BASED ON (ZC_), ZC AND ZR TERMINAL FUNCTION SELECTION
THE OUTPUT IS:
-DOMESTIC HOT WATER CIRCULATOR (FACTORY DEFAULT)
-SECOND ZONE CIRCULATOR
-WARM START ENABLE
BURNER DISCONNECT RECEPTACLE (JACKET FRONT PANEL)
N
E
L
**NOTE
BASED ON (ZC_), ZC AND ZR TERMINAL FUNCTION SELECTION
THE INPUT IS:
-DOMESTIC HOT WATER CALL FOR HEAT (FACTORY DEFAULT)
-SECOND ZONE CALL FOR HEAT
-EXTERNAL LOW LIMIT CALL FOR HEAT
CONNECTOR FOR OPTIONAL DISPLAY
24V TRANSFORMER
OIL BOILER CONTROL
OPTION PANEL
BOILER LIMIT TEMPERATURE SENSOR
AQUASTAT LIMIT CONTROL PLUG-IN OPTION CARD (OPTIONAL BY INSTALLER)
LWCO CONTROL PLUG-IN OPTION CARD (OPTIONAL BY INSTALLER)
OUTDOOR AIR TEMPERATURE RESET PLUG-IN OPTION CARD (OPTIONAL BY INSTALLER)
ENVIRACOM DISCONNECT RECEPTICLE (JACKET SIDE PANEL)
(CONNECTS TO HONEYWELL PRIMARY ENVIRACOM)
RJ45
24V THERMOSTAT (BY OTHERS)
BOILER SUPPLY TEMPERATURE SENSOR
WATER LEVEL SENSOR
OUTSIDE AIR TEMPERATURE SENSOR
DHW AQUASTAT (BY OTHERS)
(PREFERRED CONNECTION WHEN CARD IS INSTALLED)
WIRE TYPE LEGEND
LOW VOLTAGE FACTORY WIRING (SIZE 20 OR 22 AWG TYPE TEW/AWM STRANDED WIRE, 105°C)
LOW VOLTAGE FIELD WIRING
LINE VOLTAGE FACTORY WIRING (SIZE 14 AWG TYPE TW OR TEW/AWM WIRE)
LINE VOLTAGE FIELD WIRING
NOTES:
1. IF ANY OF THE ORIGINAL WIRE SUPPLIED WITH THE APPLIANCE MUST BE REPLACED, IT MUST BE REPLACED WITH THE SAME TYPE SHOWN OR ITS EQUIVALENT.
WIRE COLORS
BK - BLACK
BL - BLUE
BR - BROWN
PI - PINK
RD - RED
VI - VIOLET
WH - WHITE
YE - YELLOW
GR - GREEN
RD/BK - RED W/ BLACK TRACE

Figure 28A: Schematic Wiring Diagram

VII. ELECTRICAL (continued)



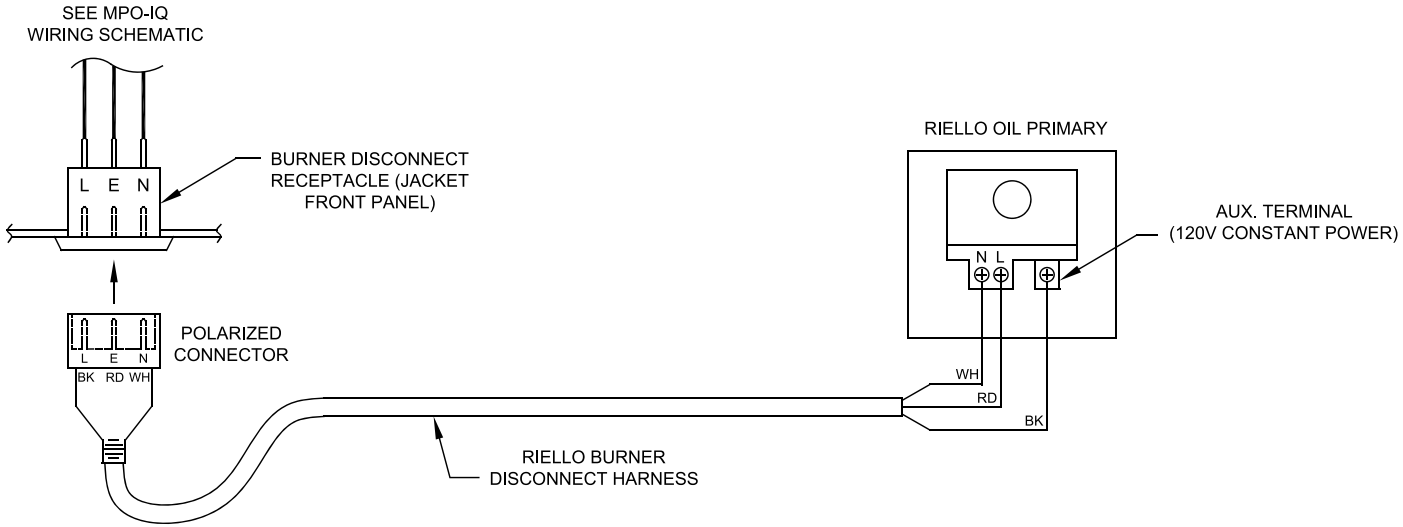


Figure 28B: Schematic Wiring Diagram, Burner Options

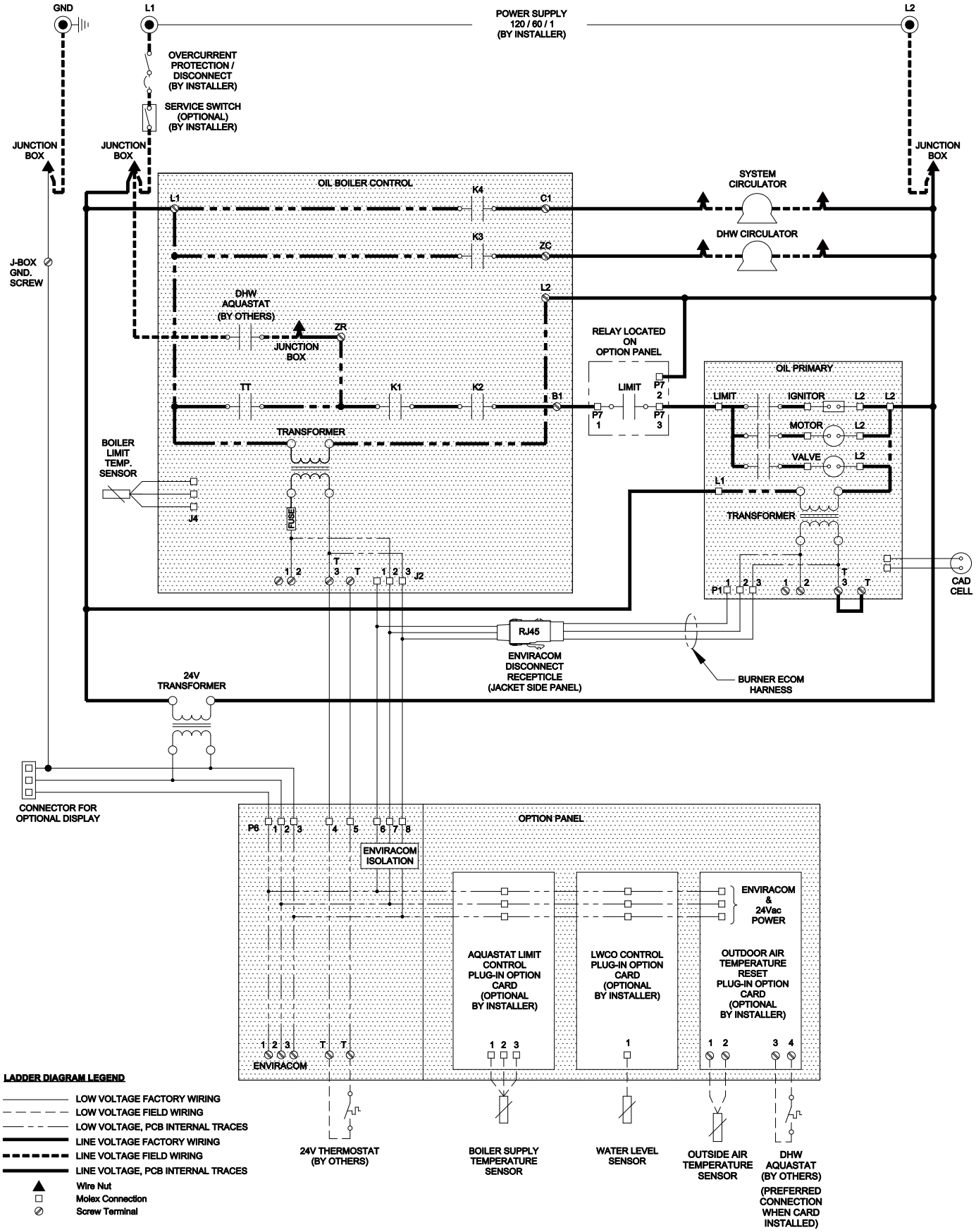


Figure 28C: Ladder Diagram

VIII. OIL PIPING

A. GENERAL

1. Use flexible oil line(s) so the burner swing door can be opened without disconnecting the oil supply piping.
2. A supply line fuel oil filter is recommended as a minimum for all firing rates but a pleated paper fuel oil filter is recommended for the firing rates below 1.0 GPH to prevent nozzle fouling.

NOTICE

Do not use compression fittings.

Oil piping must be absolutely airtight or leaks or loss of prime may result. Bleed line and fuel unit completely.

Refer to your local jurisdictions regarding any special considerations for fuel supply requirements. In addition, refer to NFPA 31, Standard for the Installation of Oil-Burning Equipment for Installations in the United States and CSA B139-04 for Installation in Canada.

3. Use of a high efficiency micron filter (Garber or equivalent) in addition to a conventional filter is highly recommended.
4. Piping used to connect the oil burner to the oil supply tank shall not be smaller than 3/8" iron pipe or 3/8" OD copper tubing. Copper tubing shall have a .032" minimum wall thickness.

WARNING

Under no circumstances can copper with sweat style connectors be used.

NOTICE

Some jurisdictions require the use of a fusible shutoff valve at the tank and/or the burner. In addition, some jurisdictions require the use of a fusible electrical interlock with the burner circuit. Check your local Codes for special requirements.

B. SINGLE PIPE OIL LINES

1. Standard burners are provided with single-stage 3450 RPM fuel units with the bypass plug removed for single-pipe installations.
2. The single-stage fuel unit may be installed single-pipe with gravity feed or lift. Maximum allowable lift is 8 feet. See Figure 29.
3. Fuel Oil Line Deaerator – On many occasions a leaky oil delivery line can introduce air into the fuel oil supply system. This often creates a rough starting condition and can create a burner lockout state. In addition to fixing the leak, a fuel line deaerator can be installed to eliminate air. The single line from the fuel tank is connected to the deaerator. The burner pump must be connected to the deaerator as a two pipe system. Follow the oil pump manufacturer's recommendations for conversion to a two pipe system.

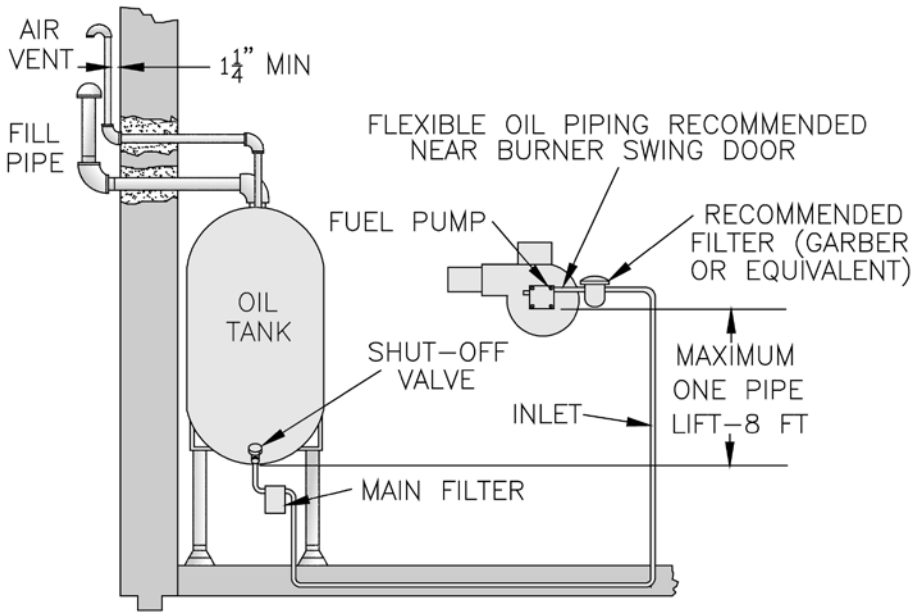


Figure 29: Single Pipe Oil Line

C. TWO PIPE OIL LINES

1. For two piped systems, where more lift is required, the two-stage fuel unit is recommended. Table 7 (two-stage) and Table 8 (single-stage) show allowable lift and lengths of 3/8 inch and 1/2 inch OD tubing for both suction and return lines. Refer to Figure 30.
2. Follow the oil pump manufacturer's recommendations on the proper connections for a two pipe system. Some manufacturers require the insertion of a bypass plug.
3. Under no circumstances is a manual shutoff valve to be located on the return line of a two pipe system. Accidental closure of the return line will rupture the oil pump seals.

TABLE 7: TWO-STAGE UNITS (3450 RPM) - TWO PIPE SYSTEMS

Lift "H" (See Fig. 25)	Maximum Length of Tubing "H" + "R" (See Figure)	
	3/8" OD Tubing (3 GPH)	1/2" OD Tubing (3 GPH)
0'	93'	100'
2'	85'	100'
4'	77'	100'
6'	69'	100'
8'	69'	100'
10	52'	100'
12'	44'	100'
14'	36'	100'
16'	27'	100'
18'	---	76'

TABLE 8: SINGLE-STAGE UNITS (3450 RPM) - TWO PIPE SYSTEMS

Lift "H" (See Fig. 25)	Maximum Length of Tubing "H" + "R" (See Figure)	
	3/8" OD Tubing (3 GPH)	1/2" OD Tubing (3 GPH)
0'	84'	100'
1'	78'	100'
2'	73'	100'
3'	68'	100'
4'	63'	100'
5'	57'	100'
6'	52'	100'
7'	47'	100'
8'	42'	100'
9'	36'	100'
10'	31'	76'
11'	26'	100'
12'	21'	83'
13'	---	62'
14'	---	41'

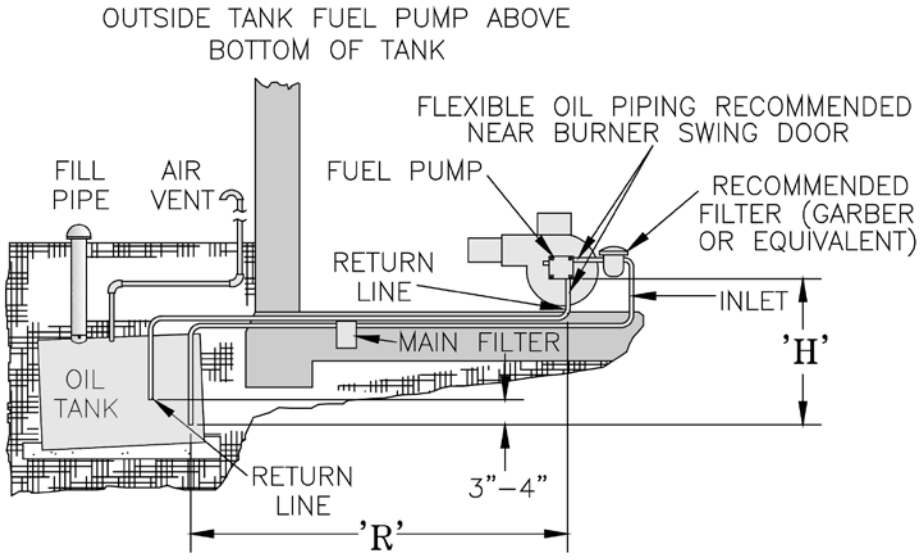


Figure 30: Two Pipe Oil Lines

IX. SYSTEM START-UP

WARNING

All boilers equipped with burner swing door have a potential hazard which can cause severe property damage, personal injury or loss of life if ignored. Before opening swing door, turn off service switch to boiler to prevent accidental firing of burner outside the combustion chamber. Be sure to tighten swing door fastener completely when service is completed. In addition, the burner power cord will have to be disconnected from the receptacle in the front jacket.

A. <u>ALWAYS INSPECT INSTALLATION BEFORE STARTING BURNER.</u>

1. Verify that the venting system is properly installed and free of obstructions prior to start-up of the boiler. Refer to Section V "Natural Draft Venting" or Section VI "Direct Venting / Air Intake Piping" in this manual.
2. Inspect electrical system to ensure proper electrical connections are made and fuses are installed. Refer to Section VII "Electrical" in this manual.
3. Verify that the oil piping is properly installed, the oil tank is filled with #2 fuel oil and oil lines have been tested. Refer to Section VIII "Oil Piping" in this manual.
4. Confirm all electrical and oil supplies are turned off at the source.

WARNING

Completely read, understand and follow all instructions in this manual before attempting start up.

B. <u>FILL HEATING SYSTEM WITH WATER.</u>

NOTICE

It is important to properly remove the oil and dirt from the system. Failure to clean the system can result in clogged air vents, circulator damage and seized zone valves. Refer to Maintenance and Service Instructions Section of this manual for proper cleaning instructions.

CLEAN HEATING SYSTEM if boiler water is dirty.

1. HOT WATER BOILERS. Fill entire heating system with water and vent air from system. Use the following procedure on a series loop or multi-zoned system installed as per Figures 13A and 13B, to remove air from system when filling:
   a. Close full port ball valve in boiler system piping.
   b. Isolate all zones by closing zone valves or shut-off valves in supply and return of each zone(s).
   c. Attach a hose to vertical purge valve in boiler system supply piping up stream from the full port ball valve. (**Note** - Terminate hose in five gallon bucket at a suitable floor drain or outdoor area).
   d. Starting with one zone at a time, open zone valve or shut-off valve in boiler supply and return piping.
   e. Open purge valve.
   f. Open shut-off valve in cold water supply piping located between the air scoop and expansion tank.
   g. Allow water to overflow from bucket until discharge from hose is bubble free for 30 seconds.
   h. When zone valve is completely purged of air, close zone valve or shut-off valve. Open zone valve to the next zone to be purged. Repeat this step until all zones have been purged. At completion, open all zone valves.
   i. Close purge valve, continue filling the system until the pressure gauge reads 12 psi. Close shut-off valve in cold water supply piping.

WARNING

The maximum operating pressure of this boiler is posted on the ASME Data Label located on the top of the boiler. Never exceed this pressure. Do not plug relief valve.

NOTICE

If make-up water line is equipped with pressure reducing valve, system will automatically fill to 12 psi. Follow fill valve manufacturer's instructions.

   j. Open full port ball valve in boiler system piping.
   k. Remove hose from purge valve.
   l. Confirm that the boiler and system have no water leaks.
   m. It may be necessary to clean the air vent assembly after a few days of operation.

C. <u>CHECK OIL BURNER BEFORE STARTING.</u>

1. Ensure that burner is tightly secured to the burner swing door creating an airtight seal.
2. CHECK BURNER AIR AND HEAD SETTINGS, readjust if necessary, see Table 16A thru 16C and 17 at rear of manual. Refer to Burner Manufacturer's Manual.
3. Adjust system thermostat(s) to highest setting.

D. START OIL BURNER.

1. Open oil supply to burner and vent fitting on fuel pump.
2. Turn 'On' electrical service switch to boiler.
3. Press Red Reset Button on front of burner, hold for one (1) second and release to reset primary control.
4. Allow burner to run until oil flows from vent fitting is a SOLID stream without air bubbles for approximately 10 seconds.

   NOTE: For Primary Control "Pump Priming Cycle" details, see Paragraph J, No. 1., Step b.
5. Close vent fitting and burner flame should start immediately after pre-purge is completed. Pre-purge prevents burner flame until 15 seconds has elapsed after initial power is applied to burner. During pre-purge the motor and igniter will operate but the oil valve will remain closed. Refer to Oil Primary Control Instructions for more details.
6. Adjust oil pressure.
   a. When checking a fuel unit's operating pressure, a reliable pressure gauge may be installed in either the bleeder port or the nozzle port. Refer to Burner Manufacturer's Manual for more details.
   b. Locate oil pressure adjusting screw and turn screw to obtain proper pump pressure, refer to Tables 16A thru 16C and 17 at rear of manual.
   c. To check the cut-off pressure, deadhead a reliable pressure gauge onto the copper connector tube attached to the nozzle port. Run the burner for a short period of time. Shut the burner off. The pressure should drop and hold.
   d. Remove the gauge and install bleeder port and/or reconnect the nozzle port line.

E. ADJUST OIL BURNER WHILE OPERATING. (flame present)

1. ADJUST DRAFT REGULATOR for a draft of zero inches (water gauge) in the canopy (see Figure 17) after chimney has reached operating temperature and while burner is running. (At least five minutes)
   See Tables 16A thru 16C and 17 at rear of manual for details.
2. READJUST THE AIR SETTING on burner for a light orange colored flame while the draft in the canopy is zero inches water column ("w.c.). Use a smoke tester and adjust air for minimum smoke (not to exceed #1) with a minimum of excess air. Make final check using suitable instrumentation to obtain a CO_2 of 11.5 to 12.5% with draft of zero inches water column ("w.c.) (water gauge) in canopy. These settings will assure a safe and efficient operating condition. If the flame appears stringy instead of a solid fire, try another nozzle of the same type. Flame should be solid and compact. After all adjustments are made recheck for a draft of zero inches water column ("w.c.) in the canopy. Replace plug at completion.
   See Tables 16A thru 16C and 17 (at rear of this manual) for details regarding the overfire pressure when baffles are both installed and removed.
3. READJUST THE HEAD SETTING.
   It might be necessary to move the head forward or back one position at a time to optimize the smoke and CO_2 readings. Refer to Burner Manufacturer's Manual for details.
4. TURN “OFF” BURNER and remove pressure gauge. Install gauge port/bleeder plug and tighten. Start burner again.

WARNING

Do not loosen or remove any oil line fittings while burner is operating.

5. FLAME FAILURE
   The Boiler Control operates the burner automatically. If for unknown reasons the burner ceases to fire and the reset button on the primary control has tripped, the burner has experienced ignition failure. Refer to Oil Primary Control Features, Paragraph J, Step 2 of this Section and Section XIII, Trouble Shooting, Paragraph B.

F. CHECK FOR CLEAN CUT OFF OF BURNER.

1. AIR IN THE OIL LINE between fuel unit and nozzle will compress when burner is on and will expand when burner stops, causing oil to squirt from nozzle at low pressure as the burner slows down and causing nozzle to drip after burner stops. Usually, cycling the burner operation about 5 to 10 times will eliminate air from the oil line.
2. IF NOZZLE CONTINUES TO DRIP, repeat Paragraph F, No. 1. If this does not stop the dripping, remove cut-off valve and seat, and wipe both with a clean cloth until clean, then replace and readjust oil pressure. If dripping or after burn persist replace fuel pump.

G. ADJUST CONTROL SETTINGS

Program boiler control (high limit, etc.) to suit individual requirements for the installation. Refer to Section X "OPERATING" to locate and adjust the control.

H. SEQUENCE OF OPERATION

The Boiler Control display provides a status display, "STA", shown in Table 10. Refer to Section X "OPERATING" to locate and view the sequence.

I. CHECK THERMOSTAT OPERATION.

Raise and lower thermostat setting as required to start and stop burner.

WARNING

Before installation of the boiler is considered complete, the operation of all boiler controls must be checked, particularly the primary control and high limit control.

J. VERIFY HONEYWELL OIL PRIMARY FEATURES using procedures outlined in Instructions furnished with control or instructions as follows:

1. R7184 / R7284 FEATURES AND CONTROLS
   a. The Oil Primary is a microprocessor-based control. The indicator light provides diagnostic information for lockout, recycling and patented cad cell status. There is a manual reset button to exit the Lockout Mode and enter the Idle Mode (see Figure 31A).
   b. Pump Priming Cycle: To facilitate purging air from the oil lines and filters, the R7184 can be placed in a purge routine by pressing and releasing the reset button during the safety check, delayed valve-on, ignition or carry-over periods.

      The R7284 can be placed in a purge routine by pressing and releasing the up arrow button during the Trial For Ignition. "Pump Prime" is shown on the oil primary display along with the time left on the Trail for Ignition (TFI). Pressing the up arrow button adds a minute to the TFI time for a maximum of 10 additional minutes. (press the up arrow button 10 times). Pressing the down arrow subtracts a minute from the TFI time (see Figure 31B).

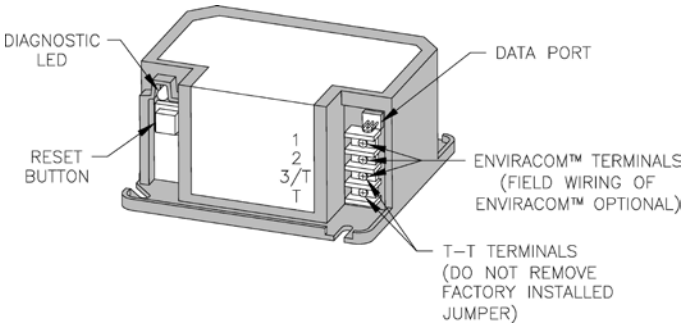


Figure 31A: R7184 Oil Primary Terminals, LED and Reset Button

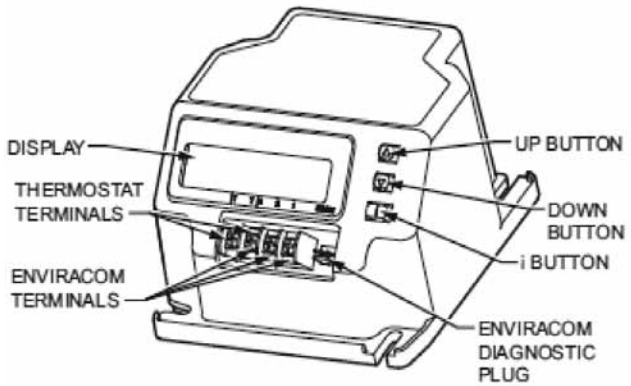


Figure 31B: R7284 Oil Primary Terminals, Display and Function Buttons

   c. Limited Recycle: This feature limits the number of recycle trials (for each call for heat) to a maximum of three trials. If the flame is lost three times and does not successfully satisfy a call for heat, the Oil Primary locks out.
   d. Limited Reset (Restricted Mode): In order to limit the accumulation of unburned oil in the combustion area, the control can only be reset three times. The reset count returns to zero each time a call for heat is successfully completed.
   e. T-T Jumper: All R7184 models have pre-installed T-T jumper. Do not remove jumper. (See Figure 31A). All R7284 models have internal "TT Configured ON" parameters set to "ON".
   f. R7184 Diagnostic LED: The indicator light on oil primary control provides lockout, recycle and cad cell indications as follows:
      - Flashing at 1 Hz (½ second on, ½ second off): system is locked out or in Restricted Mode.
      - Flashing at ¼ Hz (2 seconds on, 2 seconds off): control is in Recycle Mode.
      - On: cad cell is sensing flame.
      - Off: cad cell is not sensing flame.

      The R7284 has an LCD display and simply displays lockout and flame status on it.
   g. Cad Cell Resistance Check**:** For proper operation it is important that the cad cell resistance is below 1600 ohms.

      Cad Cell Resistance (ohms) is measured by the oil primary. The thresholds are:

      < 1600 Ohms Normal operation

      > 1600 Ohms Service burner soon

      > 6100 Ohms Flame loss, burner shuts down

      > 9999 Ohms Check for broken cell or wire.

      During a normal call for heat, once the R7184 control has entered the Run Mode, press and release the reset button. Indicator light will flash 1 to 4 flashes. See Table 9 for equivalent cad cell resistance.

      R7284 displays resistance in ohms during Running Mode.

TABLE 9: R7184 CAD CELL RESISTANCE WHEN SENSING FLAME

Flashes	Cad Cell Resistance in ohms
1	Less than 400
2	More than 400 and less than 800
3	More than 800 and less than 1600
4	More than 1600 and less than 5000

2. CHECK OIL PRIMARY CONTROL

CAUTION

Due to the potential hazard of line voltage, only a trained, experienced service technician should perform the following safety checks.

This control contains no field-serviceable parts. Do not attempt to take it apart. Replace entire control if operation is not as described.

a. Preliminary Steps

- Check wiring connections and power supply.
- Make sure power is on to the controls.
- Make sure limit control is closed.
- Check contacts between ignitor and the electrodes.
- Check the oil pump pressure.
- Check the piping to the oil tank.
- Check the oil nozzle, oil supply and oil filter.

b. Check Safety Features

Safe Start:

- Place a jumper across cad cell terminals.
- Follow procedure to turn on burner. Burner must not start, indicator light turns on and control remains in Idle Mode.
- Remove jumper.

c. Simulate Ignition or Flame Failure:

- Follow procedure to turn on burner.
- Check cad cell resistance. If resistance is below 1600 OHMS and burner runs beyond safety cut-out time, cad cell is good.

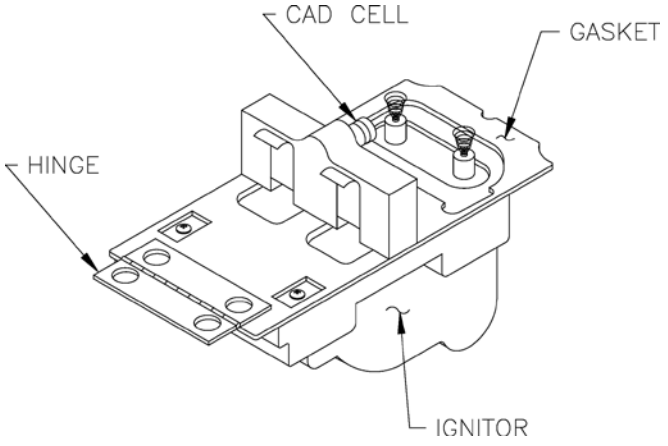


Figure 32: Cad Cell Location

- If safety switch shuts down burner and resistance is above 1600 OHMS, open line switch to boiler. Access cad cell under ignitor, clean face of cad cell and see that cell is securely in socket, see Figure 32. Check gasket around perimeter of ignitor lid for proper seal. If gasket is missing or damaged, replace gasket. Room light can effect cad cell resistance. Reset safety switch.
- Close line switch to boiler. If burner starts and runs beyond safety switch cut-off time, cell is good. If not, install new cell.
- Close hand valve in oil supply line.
- Failure occurs, device enters Recycle Mode. Indicator light flashes at ¼ Hz rate (2 seconds on, 2 seconds off) on R7184 models.
- Device tries to restart system after approximately 60 seconds.
- After third Recycle Mode trial, safety switch locks out within safety switch timing indicated on label and control enters Restricted Mode. Indicator light flashes at 1 Hz rate (½ second on, ½ second off) on R7184 models. Ignition and motor stop and oil valves closes.

d. Power Failure Check: After Flame is established, turn the power off to the control/burner. The burner should shut down safely. When power is restored a normal ignition sequence should be started.

WARNING

Cad Cell Jumper must be removed after this check.

K. CHECK HIGH LIMIT

1. Adjust system thermostat(s) to highest setting.
2. Allow burner to run until boiler water temperature exceeds high limit setting. The burner should shut down and circulators continue running.
3. Allow the temperature to drop below control setting. The burner must restart.
4. Boiler installation is not considered complete until this check has been made.

L. IF CONTROLS MEET REQUIREMENT outlined in Paragraphs I thru k.

1. Allow boiler to operate for approximately 30 minute, confirm the boiler and system have no leaks.
2. Reset thermostat(s) at desired setting.

M. IF CONTROLS DO NOT MEET REQUIREMENTS outlined in Paragraphs I thru k, replace control and repeat checkout procedures.

Important Product Safety Information
Refractory Ceramic Fiber Product

Warning:

The Repair Parts list designates parts that contain refractory ceramic fibers (RCF). RCF has been classified as a possible human carcinogen. When exposed to temperatures about 1805°F, such as during direct flame contact, RCF changes into crystalline silica, a known carcinogen. When disturbed as a result of servicing or repair, these substances become airborne and, if inhaled, may be hazardous to your health.

AVOID Breathing Fiber Particulates and Dust

Precautionary Measures:

Do not remove or replace RCF parts or attempt any service or repair work involving RCF without wearing the following protective gear:

1. A National Institute for Occupational Safety and Health (NIOSH) approved respirator
2. Long sleeved, loose fitting clothing
3. Gloves
4. Eye Protection

- Take steps to assure adequate ventilation.
- Wash all exposed body areas gently with soap and water after contact.
- Wash work clothes separately from other laundry and rinse washing machine after use to avoid contaminating other clothes.
- Discard used RCF components by sealing in an airtight plastic bag. RCF and crystalline silica are not classified as hazardous wastes in the United States and Canada.

First Aid Procedures:

- If contact with eyes: Flush with water for at least 15 minutes. Seek immediate medical attention if irritation persists.
- If contact with skin: Wash affected area gently with soap and water. Seek immediate medical attention if irritation persists.
- If breathing difficulty develops: Leave the area and move to a location with clean fresh air. Seek immediate medical attention if breathing difficulties persist.
- Ingestion: Do not induce vomiting. Drink plenty of water. Seek immediate medical attention.

X. OPERATING

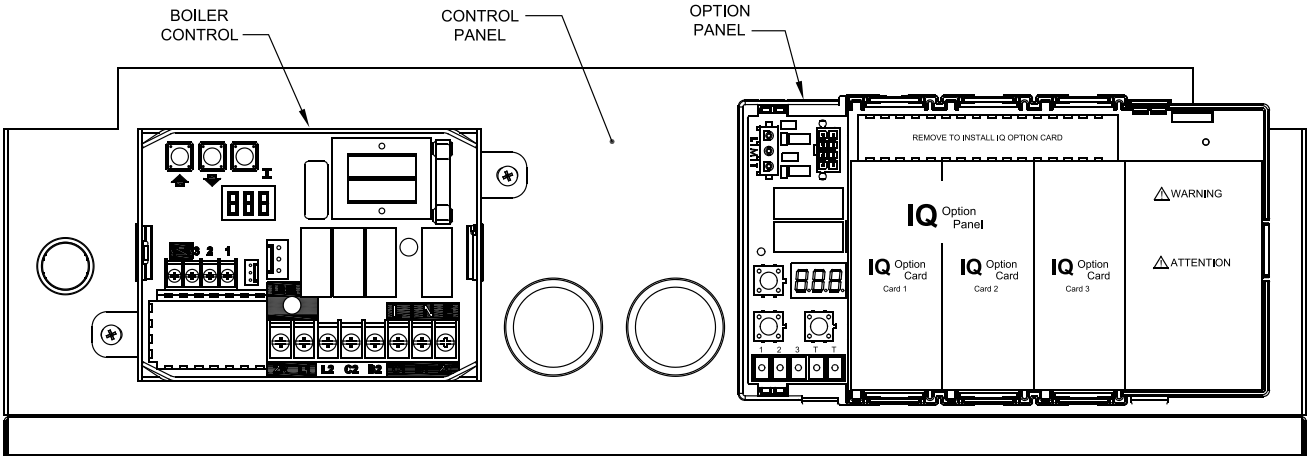


Figure 33: Boiler Control & Option Panel Orientation

A. BOILER SEQUENCE OF OPERATION

1. The boiler's sequence of operation is shown in Table 10.
2. When there is a call for heat the boiler control starts the system circulator and the thermal purge (circulator pre-purge time) begins. If the time is completed or boiler temperature is less than the Start Temperature (140 F default) the start sequence continues by energizing the oil primary to operate the following sequence: blower is started and operates for pre-purge time; spark is energized and fuel valve is opened for ignition trail time; burner fires until the thermostat is satisfied.
3. If the thermostat is not satisfied and the Operating Setpoint (SP) is reached the system circulator will continue to operate and the burner will stop. When the boiler water temperature drops below the setpoint less the differential setting the burner will restart.
4. After the thermostat is satisfied the burner and circulator are stopped.
5. When an indirect water heater aquastat call for heat is wired to the DHW input the control starts the Domestic Hot Water circulator and when boiler temperature is less than the operating setpoint energizes the oil primary to turn on the burner without circulator pre-purge delay.
6. On water boilers equipped with a High Limit Option Card, if boiler water temperature exceeds the high limit setting, the system pump will continue to operate, and the burner will stop. When the boiler water temperature drops below the High Limit Card differential setting, (15°F), the burner will restart.
7. On water boilers equipped with a LWCO Option Card, if level probe senses a low water condition, the system pump will continue to operate and the burner will stop. When water level is replenished, the burner will restart.

TABLE 10: SEQUENCE OF OPERATION

Status Code Displayed in StA Mode		
StA	**Status**	**Description**
1	Standby (*burner off, circulator off*)	No call for Heat Detected.
1	Standby (*burner off, circulator on*)	Either condition is true: a. Call for heat detected and boiler temperature higher than operating setpoint. b. Call for heat is detected and boiler temperature higher than start tempera ture (140°F default) and circulator pre-purge time has not expired.
4 *	Pre-purge	The blower is turned on for a valve-on delay.
6*	Trial For Ignition (TFI)	The igniter is turned on and the fuel valve is opened. A flame must be established within the trial for ignition time.
7*	Carryover	Once flame is established, the ignition remains on for 10 seconds to ensure flame stability and then turns off.
8	Running	The burner runs until the call for heat is satisfied. The burner is then sent to burner motor-off delay, as applicable, or it is shut down and sent to standby.
9*	Post-purge	The fuel valve is closed and the burner motor is kept on for an off delay time before the control returns the burner to standby.
10*	Retry / Recycle Delay	If the flame is lost while the burner is firing, the control shuts down the burner, enters a recycle delay, and then repeats the ignition steps outlined above. If the flame is lost three times in a row, the control locks out to prevent cycling with repetitious flame loss caused by poor combustion.
14*	Hard Lockout	If flame is not sensed by the end of the TFI, the control shuts down on safety lockout and must be manually reset. Press and hold reset button for 30 seconds to reset the restricted lockout.
15*	Waiting for Limit to Close	Heat request present and start sequence is halted due to an open limit. Open limits include high water temperature or low water detected by IQ Option Cards.
16*	Flame Present Out of Sequence	Flame signal is still present when expected to be 0 (no flame).
17	Self Test	Control internal checking.

8. On burner start, if the cad cell does not see flame during the trial for ignition, the oil primary control will shut the burner down and enter into a hard lockout. The Oil Primary must be reset manually before the burner can be restarted.

B. USING BOILER CONTROL

The Boiler Control is located under the Jacket Front Cover, to the left of the Option Panel (Refer to Figure 33).

The Boiler Control display, along with Up ⇧, Down ⇩, and "I" keys may be used to view boiler operating status (Figure 34). Please note that these keys look similar to the keys on the Option Panel but are in a different orientation, and they perform different functions.

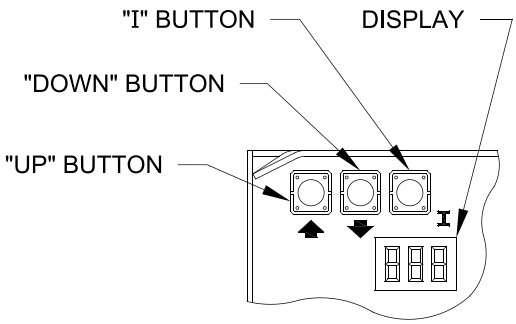


Figure 34: Boiler Control Key Function & Orientation

C. VIEWING THE OPERATING MODE OPTIONS

In operating mode the user may view (but not change) boiler operating status, settings and troubleshooting information. To view Boiler Control display information:

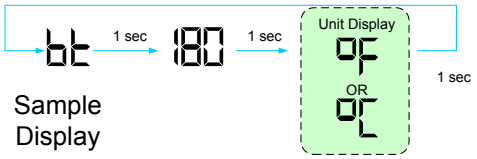
Press and release the "I" key on the Boiler Control to change from one parameter to the next. Each setting will alternately flash between the relevant display code and its corresponding value.

Operating Mode Options	
StA	Status (see Status Number in following Table)
bt	Boiler Temperature
SP	Operating Setpoint (Outdoor Reset)
HL	High Limit Setting
HdF	High Limit Differential
hr	Heat Request Status
dh	Zone Request Status
CAd*	CAD Cell Ohms
run*	Run Time Hours
CYC*	Boiler Cycles
Err	Boiler Error
ErP	External Device Error

* Visible when Burner-ECOM Harness is connected to EnviraCOM primary equipped burner. Refer to Figure 28B for installation details.

Status Number Displayed in StA Mode	
1	Standby
4*	Pre-purge
6*	Trial for Ignition
7*	Carry Over
8	Running
9*	Post-purge
10*	Retry/Recycle Delay
14*	Hard Lockout
15*	Waiting for Limit to Close
16*	Flame Present Out of Sequence
17	Self Test

For example, when the "I" key is pressed on the Boiler Control until "bt" is displayed, it will then flash a three digit number (such as " 180") followed by either "F" (or "C"). This indicates that the boiler water temperature is 180°F. Other operating parameters display the information in a similar fashion.



Please note that in operating mode to hold the display on the value the user can press and hold either the Up ⇧ or Down ⇩ keys and the value will be continuously shown. This may be helpful in watching a value "live".

D. USING THE OPTION PANEL

Option Cards are available from distributors and are the simplest way to add functionality, safety and efficiency to your heating system. The Option Panel provides an easy and convenient means to "plug-in" an Auxiliary High Limit, Low Water Cut-off and/or Outdoor Reset function. For operating instructions, refer to the instructions supplied with those cards.

E. USING THE OPTIONAL LCD DISPLAY KIT (P/N 102728-01)

The LCD Display is an easy to use touch screen type display that allows a technician to monitor and adjust the Boiler Control and connected Option Cards. All boiler settings, status and error codes are displayed in full text. All Outdoor Reset Option Card parameters are adjustable with graphic and help information screens. The LCD Display Kit includes a mounting bracket and a simple plug-in wiring connection to allow mounting in the plastic hood above the burner door.

For installation instructions, refer to the instructions supplied with the display.

X. OPERATING (continued)

F. CHANGING THE ADJUSTABLE PARAMETERS

To adjust parameters such as the High Limit Setpoint and High Limit Differential:

1. Using the Boiler Control display, access the adjustment mode by pressing and holding the Up ⇧, Down ⇩, and "▣" keys simultaneously for three (3) seconds. This procedure is intended to discourage unauthorized changes or accidental changes to limit settings.
2. Press the "▣" key to display available Adjustment Mode options. Select an option.

Adjustment Mode Options		
HL_	140-240°F	Adjust High Limit Setting
HdF	10-30°F	Adjust High Limit Differential
ZC_	dh, Zr or ELL	ZC and ZR Terminal Function
Or_	0-10 minutes	Pump Overrun Time
PP_	0-20 minutes	Pump Pre-purge Time
St_	140 - 180°F	Start Temperature
Pt_	On or OFF	Priority Time
F-C	F or C	Select degrees F or C Mode
bAc		Back to Operating Mode

3. Press the Up ⇧ and Down ⇩ keys to adjust the displayed setpoint to the desired value.
4. To return to the normal operating mode from the Adjustment Mode, when the "bAc" option is displayed, press either the Up ⇧ or Down ⇩ key. If no keys are pressed, after five (5) minutes the Boiler Control will automatically return to the Operating Mode.

G. MORE INFORMATION ABOUT ADJUSTABLE PARAMETERS

1. High Limit (HL_)

   The Boiler Control is factory programmed with a High Limit Setpoint of 180°F. The boiler turns "off" when the boiler water temperature (bt) is above this value. The High Limit setpoint is adjustable between 140° and 240°F. The Operating Setpoint (SP) will equal the High Limit Setpoint unless an Outdoor Reset Option Card is installed. The Outdoor Reset Option Card reduces the Operating Setpoint to regulate heat delivery, increase home comfort and save energy. Refer to Appendix A for additional information.

2. Differential (HdF)

   The Boiler Control is factory programmed with a Differential of 15°F. The Differential is the number of degrees the boiler temperature must decrease below the Operating Setpoint before the boiler can restart. The differential is adjustable between 10° and 30°F.

3. Circulator Overrun Time (Or_)

   Circulator Overrun Time (also called "circulator off delay" or "circulator post purge") continues circulator operation after a call for heat has ended, sending excess heat from the boiler into the priority zone. Ensure system piping and zone panel settings allow water flow to the priority zone after the call for heat ends. The Circulator Overrun Time has a factor setting of 0 minutes and is field adjustable between 0 and 10 minutes.

5. Circulator Pre-Purge Time (PP_)

   When the boiler is warm [boiler water temperature higher than 140°F (adjustable using Start Temperature parameter)] and there is a thermostat call for heat, the system circulator is started and boiler firing is delayed pre-purge minutes. If the temperature drops below 140°F or there is a DHW Call for Heat the boiler is started without delay. Additionally, the boiler is started without delay if the thermostat call for heat is initiated when the boiler water temperature is less than 140°F. This feature helps save energy by satisfying home heating needs with residual boiler heat rather than cycling the boiler. The Circulator Pre-purge time has a factory setting of 2 minutes and is field adjustable between 2 and 20 minutes. When reset card is installed pre-purge time may be adjusted down to zero (0) minutes. Refer to Table 11.

TABLE 11: CIRCULATOR PRE-PURGE TIME EXAMPLE, PARAMETER PP_= 2 MINUTES

Call for Heat	**ZC** and **ZR** Terminal Function (ZC_)	Boiler Temp.	Boiler Status, (B1 Output)
TT= on	--	< 140	Start with no delay
TT = on	--	>140	Start after 2 minute delay
ZR = on	ZC_ = Zr	<140	Start with no delay
ZR = on	ZC_ = Zr	>140	Start after 2 minute delay
ZR = on	ZC_ = dH	<140	Start with no delay
ZR = on	ZC_ = dH	>140	Start with no delay

6. Start Temperature (St_)

   The amount of "Heat available" is calculated by taking the difference between measured boiler water temperature and the Start Temperature setting. Useful "Heat Available" is dependent on the type of heating emitter installed in the home. Heat emitters require a certain minimum temperature to operate effectively. Our default settings reflect cast iron radiators. Fan Coils may require a start temperature setting of 180°F or 160°F before providing heat to the home. The Start Temperature has a factory setting of 140°F and is field adjustable between 140°F and 180°F.

7. Priority Time (Pt_)

   When the Priority Time parameter is set to “on” and Domestic Hot Water (DHW) call for heat is “on” the DHW demand will take “Priority” over home heating demand and the system circulator will be forced “off”. Priority Time ends and the system circulator is released to service home heating demand when Domestic Hot Water call for heat is over. When Priority Time parameter is set to “Off” the DHW call for heat does not force “off” the system circulator. The Priority Time has a factory setting of “On” and is field adjustable between “On” and “Off” Refer to Table 12A.

8. ZC and ZR Terminal Function

   The boiler control allows configuration of the ZC output functionality to help the MPO-IQ integrate into each installation more effectively. The ZC output can be connected to a domestic hot water circulator or a second heating zone circulator or be used to enable pumps in a warm start application. These applications are selected as follows:

   a. When 2C_ is set equal to Domestic Hot Water Demand (dh)

      When there is an Indirect Water Heater (IWH) the boiler control provides a “ZR” input terminal for the IWH Aquastat and “ZC” output terminal for the DHW Circulator. When there is a DHW call for heat, the System Circulator is “forced off”, the DHW Circulator terminal is energized and the circulator pre-purge time delay control logic is bypassed to allow the boiler to fire without delay. When DHW demand ends the System Circulator “force off” is removed, the circulator can respond normally, and the DHW Circulator is de-energized. The DHW call for heat is detected by a voltage on to the ZR terminal. When a Priority Time parameter is set to “off” the System Circulator is not forced off for a DHW call for heat. Refer to Table 12A.

      When an Outdoor Air Reset Option Card is installed and there is a DHW call for heat there is an adjustable DHW Temperature Setpoint and Priority Timer included. Refer to Table 12B.

   b. When 2C_ is set equal to Zone Request (2r)

      When there is no IWH the “ZC” output may be configured to control a second heating zone. This is particularly helpful when the home uses only two heating zones. The boiler control replaces the need for a two circulator zone panel. When DHW Terminal Function (dh_) is set to “2r” the boiler control’s two circulator outputs are used to control two independent heating zones. Refer to Table 13. A "TT" input causes a call for heat and energizes the System Circulator output to service heating zone 1. A second zone’s thermostat may be wired to the "ZR" input to energize heating zone 2 circulator wired to the "ZC" output. Both outputs function independently, "TT" input controls only the System Circulator output and the "ZR" input controls only the "ZC" output. Both inputs cause a boiler call for heat.

TABLE 12A: DOMESTIC HOT WATER DEMAND, (PARAMETER 2C_ = dH)

Call for Heat			Circulator Status	
T-T Input	**ZR** Input	Priority Time (Pt_)	**System Circulator Output**	**DHW Circulator ZC Output**
on	off	On	on	off
on	on	On	off	on
off	on	On	off	on
on	off	OFF	on	off
on	on	OFF	on	on
off	on	OFF	off	on

TABLE 12B: DOMESTIC HOT WATER DEMAND, (PARAMETER 2C_ = dH) Outdoor Air Reset Option Card Installed.

Call for Heat		Outdoor Air Reset Option Card P/N 102294-01			Circulator Status	
T-T Input	**ZR** Input	DHW Input	Priority time	Priority Time Expired?	**C1** Output	**ZC** Output
off	--	off	> 0	no	off	off
on	--	off	> 0	no	on	off
on	--	on	> 0	no	off	on
on	--	on	> 0	yes	on	on
on	--	on	= 0	no	on	on
off	--	on	= 0	no	off	on

TABLE 13: ZONE REQUEST, PARAMETER 2C_ = 2r

Call for Heat		Circulator Status	
T-T Input	**ZR** Input	**C1** Output	**ZC** Output
off	off	off	off
on	off	on	off
on	on	on	on
off	on	off	on

c. External Low Limit, Parameter 2C = ELL

The boiler control is capable of functioning as a warm start control when external limit control is installed that closes a contact when boiler water temperature falls below a setpoint. When an external limit contact closes (boiler water is cold) the boiler is started and the ZC and C1 output terminals are de-energized. When the ZR terminal is de-energized (boiler water temperature is above setpoint) the call for heat is ended and the C1 terminal is released to operation and the ZC terminal is energized. An External Low Limit Request is detected by sensing a voltage on the ZR terminal. Refer to Table 14.

TABLE 14: EXTERNAL LOW LIMIT, PARAMETER 2C_= ELL

Call for Heat		Circulator Status	
T-T Input	**ZR** Input	**C1** Output	**ZC** Output
off	off	off	on
on	off	on	on
on	on	off	off
off	on	off	off

XI. MAINTENANCE AND SERVICE INSTRUCTIONS

A. MAINTENANCE OF LOW WATER CUT-OFF DEVICES (when installed)

See Instructions provided with Low Water Cut-off Option Card for Installation Instructions.

WARNING

Probe type low water cut-off devices require annual inspection and maintenance.

1. PROBE TYPE LOW WATER CUT-OFF

Although these devices are solid state in their operation, the probe is exposed to possible contamination in the boiler water and subject to fouling.

Sometimes the LWCO can be found in the primary loop of the boiler system. Ideally, shut off valves have been installed between the loop containing the LWCO and the rest of the system, to minimize the amount of system draining.

It is important to physically remove the probe from the LWCO tapping annually and inspect that probe for accumulation of scale or sediment.

Follow these steps to inspect, clean and/or replace the probe:

a. Turn off electric service to the boiler.
b. Drain boiler water to a level below the tapping for the probe.
c. Disconnect wiring connections between the low water cut-off control and the probe.
d. Remove the low water cut-off control from the probe.

DANGER

Assure that the boiler is at zero pressure before removing the LWCO probe. Do not rely on the pressure gauge to indicate that the boiler is at zero pressure. Open the safety valve to relieve all internal pressure prior to proceeding. Safety valve discharge piping must be piped such that the potential for burns is eliminated.

e. Unscrew the probe from the LWCO tapping.
f. Inspect that portion of the probe that is exposed to the water for a scale or sediment buildup.
g. Light deposits may be removed by wiping the probe with a damp cloth. Wiping the probe with a cloth soaked in vinegar will remove more tenacious lime deposits. The most stubborn deposits may be removed from the probe by using a diluted amount, 3 parts of water to 1 part of phosphoric acid (H_2PO_4).

CAUTION

Exercise caution when handling phosphoric acid and follow the instruction label on its container.

h. Clean the pipe threads of the probe to remove old, hardened pipe dope and other foreign matter.
i. Apply a moderate amount of good quality pipe dope to the pipe threads on the probe, leaving the two end threads bare. Do not use PTFE (Teflon) tape.
j. Screw the probe into the LWCO tapping.
k. Mount the low water cut-off control on the probe.
l. Reconnect the control to probe wiring.
m. Fill the system with water.
n. Add boiler water treatment compound as needed (refer to Paragraph B.).
o. Restore electric service to the boiler.
p. Fire burner to bring the water in the boiler to a boil to drive off free oxygen.
q. WARNING — BEFORE RETURNING BOILER TO SERVICE: Follow the low water cut-off instructions provided with Low Water Cut-off Option Card.

B. BOILER AND SYSTEM CLEANING INSTRUCTIONS FOR TROUBLE FREE OPERATION

1. *Filling of Boiler and System — General* —-In a hot water heating system, the boiler and entire system (other than the expansion tank) must be full of water for satisfactory operation. Water should be added to the system until the boiler pressure gauge registers 12 psi. To insure that the system is full, water should come out of all air vents when opened.
2. *Boiling Out of Boiler and System.* The oil and grease which accumulate in a new hot water boiler can be washed out in the following manner.
   a. Ideally, shut off valves have been installed between the boiler return manifold and the rest of the system, to minimize the amount of system draining.
   b. Drain the boiler to a level below the relief valve tapping.

DANGER

Assure that the boiler is at zero pressure before removing the relief valve. Open the safety valve to relieve all internal pressure prior to proceeding. Safety valve discharge piping must be piped such that the potential for burns is eliminated.

c. Remove relief valve using extreme care to avoid damaging it.
d. Add an appropriate amount of recommended boil out compound.
e. Replace relief valve.
f. Fill the entire system with water.
g. Start firing the boiler.
h. Circulate the water through the entire system.
i. Vent the system, including the radiation.
j Allow boiler water to reach operating temperature, if possible.
k. Continue to circulate the water for a few hours.
l. Stop firing the boiler.
m. Drain the system in a manner and to a location that hot water can be discharged with safety.
n. Remove plugs from all available returns and wash the water side of the boiler as thoroughly as possible, using a high-pressure water stream.
o. Refill the system with fresh water.

3. Add appropriate boiler water treatment compounds as recommended by your qualified water treatment company.
4. *Make pH or Alkalinity Test.*

   After boiler and system have been cleaned and refilled as previously described, test the pH of the water in the system. This can easily be done by drawing a small sample of boiler water and testing with hydrion paper which is used in the same manner as litmus paper, except it gives specific readings. A color chart on the side of the small hydrion dispenser gives the reading pH. Hydrion paper is inexpensive and obtainable from any chemical supply house or through your local druggist. The pH should be higher than 7 but lower than 11. Add appropriate water treatment chemicals, if necessary, to bring the pH within the specified range. With this lower level of protection, care must be exercised to eliminate all of the free oxygen in the system.
5. Boiler is now ready to be put into service.

C. <u>EXCESSIVE MAKE-UP WATER</u>

A leaky system will increase the volume of make-up water supplied to the boiler which can significantly shorten the life of the boiler. Entrained in make-up water are dissolved minerals, salts and oxygen. When the fresh, cool make-up water is heated in the boiler the minerals fall out as sediment, the salts coat the inside of the boiler, and the oxygen escapes as a gas. The accumulation of sediment eventually isolates the water from contacting the cast iron. When this happens the cast iron in that area gets extremely hot and eventually cracks. The presence of free oxygen or chloride salts in the boiler corrodes the cast iron from the inside. More make-up water and higher concentrations of contaminants damage the boiler sooner. **Our warranty does not cover corrosion and sediment-related damage.** Clearly it is in everyone's best interest to prevent this type of failure. You can do your part by ensuring that your system is leak-free, keeping leakage to less than 2 percent of the boiler water volume each month.

IMPORTANT

IF, DURING NORMAL OPERATION, IT IS NECESSARY TO ADD MORE WATER THAN INDICATED BELOW, CONSULT A QUALIFIED SERVICE TECHNICIAN TO CHECK YOUR SYSTEM FOR LEAKS.

Model No.	Gallons Per Month	Gallons Per Year
MPO-IQ84 / 115	0.20	2.4
MPO-IQ147	0.25	3.0
MPO-IQ189	0.30	3.6
MPO-IQ231	0.40	4.8

D. <u>ATTENTION TO BOILER WHILE NOT IN OPERATION.</u>

NOTICE

If boiler is not used during winter time, it must be fully drained to prevent freeze damage.

1. Spray inside surfaces with light lubricating or crankcase oil using gun with extended stem so as to reach all corners.
2. Always keep the manual fuel supply valve shut off if the burner is shut down for an extended period of time.
3. To recondition the heating system in the fall season after a prolonged shut down, follow the instructions outlined in Section X, Paragraphs A through M.

WARNING

This boiler contains controls which may cause the boiler to shut down and not restart without service. If damage due to frozen pipes is a possibility, the heating system should not be left unattended in cold weather; or appropriate safeguards and alarms should be installed on the heating system to prevent damage if the boiler is inoperative.

XII. BOILER CLEANING

WARNING

All boiler cleaning must be completed with burner service switch turned off. Boilers equipped with burner swing door have a potential hazard which can cause severe property damage, personal injury or loss of life if ignored. Before opening swing door, turn off service switch to boiler to prevent accidental firing of burner outside the combustion chamber. Disconnect the burner plug from the receptacle in the front jacket. Be sure to tighten swing door fastener completely when service is completed.

A. CLEAN THE FLUEWAYS (See Figure 35).

1. For access to the combustion chamber remove the two (2) 3/8" - 16 cap screws. If boiler is equipped with flexible fuel line(s), swing door open.
2. Remove the two smoke box clean-out covers from the rear smoke box by removing the four 5/16"-18 hex head bolts. It is NOT necessary to remove the vent connector from the smoke box to clean boiler.

   If necessary, remove the vent connector if there is evidence of heavy soot accumulation in the boiler or to inspect base of chimney for condensate or accumulation of debris.
3. Remove the baffles (if installed) from the flue passages. Refer to Section II, Paragraph F for Baffle Installation.
4. Clean the 3rd Pass – Insert a 2" dia. x 42" long wire or fiber bristle brush into each of the two 3rd passes. Using long strokes push the brush all the way through the boiler until the brush has exited the smoke box opening. Pull the brush all the way forward until it has exited the front of the boiler. Continue this operation for the entire height of the flue way until clean. Repeat the operation for the other 3rd pass flue way.
5. Clean the 2nd Pass - Insert a 2" dia. x 42" long wire or fiber bristle brush into each of the two 2nd passes. Using long strokes push the brush all the way through the boiler until the brush hits the back wall of the reversing chamber. Pull the brush all the way forward until it has exited the front of the boiler. Continue this operation for the entire height of the flue way until clean. Repeat the operation for the other 2nd pass flue way.
6. Vacuum the loose debris in the bottom of the combustion chamber and smoke box.

B. CLEAN THE COMBUSTION CHAMBER – Use a wire or fiber bristle brush to clean the surfaces of the combustion chamber. Vacuum all of the loose debris in the bottom of the combustion chamber.

C. AFTER CLEANING, vacuum all remaining debris as necessary. Inspect burner swing door insulation, and rope gasket for signs of damage. If damaged, replace as needed.

D. REASSEMBLE BOILER.

CAUTION

Do not start the burner unless the burner swing door and canopy cover plates are secured in place.

1 Insert the baffles (if originally installed) into the correct flue way. Refer to Section II, Paragraph F for Baffle Installation.

2. Attach the smoke box clean-out covers onto the rear of the boiler. Verify that the rope gasket is in good working order before assembly. Replace rope gasket if necessary. Use the 3/8" hardware originally removed. Do not over tighten. They should be snug but not bottomed out.

NOTICE

When securing burner swing door make sure door is drawn-in equally on both sides.

Tighten swing door hardware to provide adequate seal to rope gasket around perimeter of door.

Use an alternating tightening method from right side to left side cap screw to pull door tight equally.

NOTICE

Do not overtighten. The rope gasket will provide sufficient seal when the door is snugged into place.

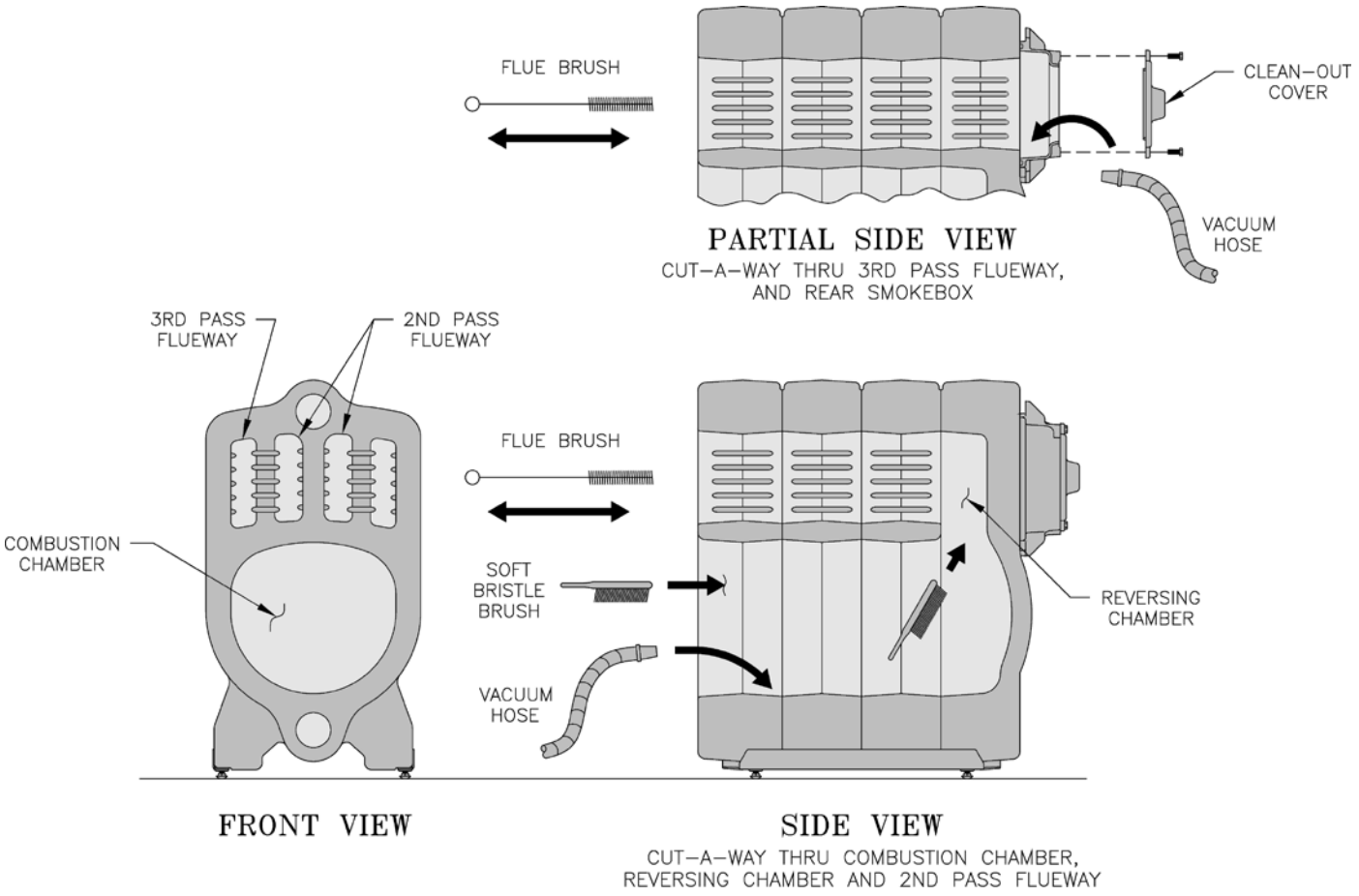


Figure 35: Cleaning of Boiler Flueways

WARNING

The boiler must be connected to an approved chimney in good condition. Serious property damage could result if the boiler is connected to a dirty or inadequate chimney. The interior of the chimney flue must be inspected and cleaned before the start of the heating season and should be inspected periodically throughout the heating season for any obstructions. A clean and unobstructed chimney flue is necessary to allow noxious fumes that could cause injury or loss of life to vent safely and will contribute toward maintaining the boiler's efficiency.

XIII. TROUBLE SHOOTING

A. COMBUSTION

1. NOZZLES — Although the nozzle is a relatively inexpensive device, its function is critical to the successful operation of the oil burner. The selection of the nozzle supplied with the MPO-IQ boiler is the result of extensive testing to obtain the best flame shape and efficient combustion. Other brands of the same spray angle and spray pattern may be used but may not perform at the expected level of CO_2 and smoke. Nozzles are delicate and should be protected from dirt and abuse. Nozzles are mass-produced and can vary from sample to sample. For all of those reasons a spare nozzle is a desirable item for a serviceman to have.
2. FLAME SHAPE — Looking into the combustion chamber through the observation port, the flame should appear straight with no sparklers rolling up toward the crown of the chamber. If the flame drags to the right or left, sends sparklers upward or makes wet spots on the chamber walls, the nozzle should be replaced. If the condition persists look for fuel leaks, air leaks, water or dirt in the fuel as described above.
3. FUEL LEAKS — Any fuel leak between the pump and the nozzle will be detrimental to good combustion results. Look for wet surfaces in the air tube, under the ignitor, and around the air inlet. Any such leaks should be repaired as they may cause erratic burning of the fuel and in the extreme case may become a fire hazard.
4. AIR LEAKS — Any such leaks should be repaired, as they may cause erratic burning of the fuel and in extreme cases may become a fire hazard.
5. GASKET LEAKS — If 11.5 to 12.5% CO_2 with a #1 smoke cannot be obtained in the breeching, look for air leaks around the burner mounting gasket, observation door, and canopy gasket. Such air leaks will cause a lower CO_2 reading in the breeching. The smaller the firing rate the greater effect an air leak can have on CO_2 readings.
6. DIRT — A fuel filter is a good investment. Accidental accumulation of dirt in the fuel system can clog the nozzle or nozzle strainer and produce a poor spray pattern from the nozzle. The smaller the firing rate, the smaller the slots become in the nozzle and the more prone to plugging it becomes with the same amount of dirt.
7. WATER — Water in the fuel in large amounts will stall the fuel pump. Water in the fuel in smaller amounts will cause excessive wear on the pump, but more importantly water doesn't burn. It chills the flame and causes smoke and unburned fuel to pass out of the combustion chamber and clog the flueways of the boiler.
8. COLD OIL — If the oil temperature approaching the fuel pump is 40°F or lower, poor combustion or delayed ignition may result. Cold oil is harder to atomize at the nozzle. Thus, the spray droplets get larger and the flame shape gets longer. An outside fuel tank that is above grade or has fuel lines in a shallow bury is a good candidate for cold oil. The best solution is to locate the tank near the boiler in the basement utility room or bury the tank and lines deep enough to keep the oil above 40°F. Check environmental issues with local authorities having jurisdiction.
9. HIGH ALTITUDE INSTALLATIONS—Air openings must be increased at higher altitudes. Use instruments and set for 11.5 to 12.5% CO_2.
10. START-UP NOISE — Late ignition is the cause of start-up noises. If it occurs recheck for electrode settings, flame shape, air or water in the fuel lines.
11. SHUT DOWN NOISE — If the flame runs out of air before it runs out of fuel, an after burn with noise may occur. That may be the result of a faulty cut-off valve in the fuel pump, or it may be air trapped in the nozzle line. It may take several firing cycles for that air to be fully vented through the nozzle. Water in the fuel or poor flame shape can also cause shut down noises.

NOTICE

CHECK TEST PROCEDURE. A very good test for isolating fuel side problems is to disconnect the fuel system and with a 24" length of tubing, fire out of an auxiliary five gallon pail of clean, fresh, warm #2 oil from another source. If the burner runs successfully when drawing out of the auxiliary pail then the problem is isolated to the fuel or fuel lines being used on the jobsite.

B. OIL PRIMARY CONTROL (Oil Primary)

1. Burner (Oil Primary) will not come on.
   a. No power to Oil Primary.
   b. Oil Primary is in lockout or restricted mode. Press reset button for one (1) second to exit lockout. If control has recycled three times within the same call for heat, it will enter into restricted mode. To reset from restricted mode, refer to Section XI, Paragraph I, No. 2 for details.
   c. CAD cell seeing light.
   d. CAD assembly defective.
   e. Control motor relay is stuck closed (see note below).
2. Burner (control) will light, then shut down after a short time, then restart after one (1) minute.
   a. CAD cell is defective.
   b. Air leaking into oil line causing flame out.
   c. Defective nozzle causing flame to be erratic.
   d. Excessive airflow or draft causing flame to leave burner head.
   e. Excessive back pressure causing flame to be erratic.

3. Control locks out after Trial For Ignition (TFI).
   a. No oil to burner.
   b. Shorted electrodes.
   c. Nozzle clogged.
   d. Airflow too high.
   e. Ignitor module defective.
   f. CAD cell defective.
   g. Oil valve stuck open or closed.

   Note: The Safety Monitoring Circuit (SMC) is designed to provide lockout in the event of a stuck or welded motor relay.

NOTICE

If flame is not established within 15 seconds of oil valve actuation (known as Trial For Ignition [TFI]) lockout will occur. Lockout is indicated by a red LED solid-on located on the oil primary control.

Hard Lockout will occur if the Oil Primary Control locks-out three (3) times during a call for heat. This is indicated by red light reset button solid-on.

C. IQ OIL BOILER CONTROL

When a problem occurs with the boiler operation, the IQ Control System easily provides specific, valuable information to help resolve the issue quickly. The display on the Boiler Control should be the first place to check, see Figure 36.

1. Error Code "Err" **IS NOT** displayed on the Boiler Control: This is one of two conditions that occur when a problem arises. In this circumstance, the following table can be used to determine the problem and possible causes.

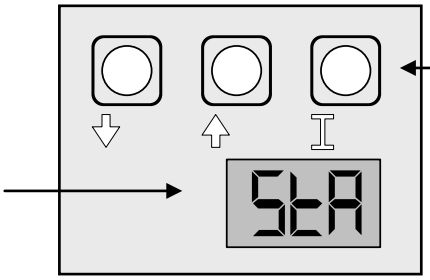
D. BEFORE TROUBLESHOOTING

The following pages contain trouble shooting tables for use in diagnosing control problems. When using these tables the following should be kept in mind:

1. This information is only meant to be used by a professional heating technician as an aid in diagnosing boiler problems.
2. Where applicable, follow all precautions outlined in Section IX, System Start-Up .
3. In general, these tables assume that there are no loose or miswired electrical connections. Before using these tables inspect all electrical connections on the boiler to

Operating Mode Parameters

StA	Status (see Status Numbers)
bt	Boiler Temperature
SP	Operating Setpoint (Outdoor Reset)
HL	High Limit Setpoint
HdF	High Limit Differential
hr	Heat Request Status
dh	DHW Heat Request Status
CAd	Cad Cell Resistance (ohms)
run	Run Time Hours
CyC	Boiler Cycles
Err	Error (see Error Numbers)
ErP	External Device Error (see Error Numbers)



Press "I" key on the control to change from one parameter to the next. Each setting will alternate between display code (for example StA) and value.

Figure 36: Boiler Control User Interface

Possible StA (status) Values:

StA Value	Description
1	Standby
4	Pre-purge
6	Trial for Ignition
7	Carryover
8	Running
9	Post-Purge
10	Retry/Recycle Display
14	Hard Lockout
15	Waiting for Limit to Close
16	Flame Present Out of Sequence
17	Self Test

Possible Err (Boiler Control Error) Values:

Err Value	Description
1	Temperature Sensor Fault
2	Communications Fault
3	Internal Hardware Fault
4	Burner Output (B1) Fault
5	Line Voltage Fault (< 80 Vac)
6	Fuse Missing
7	User Setting Lost, (reset to factory defaults)
8	Manual Reset Lockout (resettable)

make sure that they are tight. Also, check the wiring on the boiler against the wiring diagram in Figures 28A, 28B and 28C. Ensure that incoming 120 Vac power polarity is correct and that the boiler is properly grounded.

4. A defective control or component is generally the least likely cause. Before replacing a component, try to rule out all other possible causes.
5. When checking voltage across wiring harness pins be careful not to insert the meter probes into the pins. Doing so may damage the pin, resulting in a loose connection when the harness is reconnected.

Possible ErP (External Error) Values:

ErP Value	Description
4	Warning, Cad Cell Resistance High (Service Required)
5	No Ignition, Check Cad Cell
9	Warning, Flame Proven, Late in Trial
10	No Ignition, Check Ignition Transformer
18	Internal Error, Electronics Failure
20	No Ignition
21	No Ignition, After Flame Loss During Run
22	Flame Lost During Run Three Times In A Row
23	Flame Out of Sequence, During Pre-Purge
24	Flame Out of Sequence, During Post-Purge
25	Oil Primary Lockout, Manual Reset Required

Possible ErP (External Error) Values (continued):

ErP Value	Description
34	Cad Ohms Permanently Low (Flame Out of Sequence)
35	Duplicate Zone
58	AC Line Frequency Error
59	AC Line Voltage Error
84	Low Water Event
89	Communication Lost
91	Communication Error
119	Sensor Failure
140	Low Probe Signal
141	Manual Reset Lockout

E. USE BOILER CONTROL DISPLAY Err AND ErP NUMBERS TO DIRECT TROUBLESHOOTING

If the Boiler Control detects an error it will flash "Err" (boiler control error) or "ErP" (external error) followed by a number. Use this text and number to identify the boiler problem and corrective action in the table below. If there is no error display proceed to Paragraph E:

TABLE 15A: BOILER CONTROL ERROR NUMBERS

Display	Status	Recommended Corrective Actions
Err 1	Temperature Sensor Fault	Temperature sensor failure, wire harness loose or shorted connection or control hardware failure: - Check sensor is securely attached to boiler control - Check that sensor wire is not damaged - If secure and in good condition, replace sensor - If problem persists, replace control
Err 2	Communication Fault	Enviracom terminal is shorted to ground or line voltage. - Check wiring to EnviraCOM terminals 1,2 and 3. Wiring to external EnviraCom device is incorrect.
Err 3	Internal Hardware Fault	Error detected with AC power supply frequency or boiler control failure. Cycle power to the control. Replace control if problem persists.
Err 4	Burner Output (B1) Fault	B1 output sensed powered during safety output relay check sequence or un-powered during running, or powered in idle in combination with water temperature above 264°F limit. Cycle power to the control. Replace control if problem persists.
Err 5	Line Voltage Fault (< 80 Vac)	AC voltage out of specification high or low; check L1, L2, 110 VAC.
Err 6	Fuse missing	Internal fuse is blown or missing. The fuse protects the Aquastat from miss wiring the L1 and L2 on Oil Primary. When the Oil Primary is correctly wired the fuse is useless and not detected. If Primary is wired incorrectly the fuse is blown out and Aquastat report error 6. EnviraCOM message is sent when the wiring is fixed and the error disappears to indicate the end of the error state. Check wiring and replace fuse.
Err 7	User settings lost, (reset to factory defaults)	Warning: Generated if user adjustments are lost and the device uses factory default values. Error is cleared by entering and exiting the Adjustment mode. Replace control if problem persists.
Err 8	Manual Reset Lockout (resettable)	Set if Err 4 was invoked four times in a row. Check wiring and clear Lockout by pressing all three user keys for 30 seconds.

XIII. TROUBLE SHOOTING (continued)

E. USE BOILER CONTROL DISPLAY Err AND ErP NUMBERS TO DIRECT TROUBLESHOOTING (continued)

TABLE 15B: EXTERNAL DEVICE (Oil Primary, Option Card, etc.) ERROR NUMBERS

Display	Status	Recommended Corrective Actions
ErP 4	Warning, Cad Cell Resistance High (service required)	The cad cell resistance is higher than normal while running, the system is in need of a tune up. - Check for proper alignment of the cad cell and clean the eye if necessary. - Check if the pump is generating adequate pressure. - Check burner adjustments (refer to burner manufacturers instructions). - Check for excessive soot build up in the burner and flue. - Check for flue blockage.
ErP 5	No Ignition, Check Cad Cell	The cad cell detected some amount of light during the ignition trial, but not enough to enter run mode. - Check the cad cell positioning and clean the eye. - Set the display to show the cad cell resistance. - Shield the cad cell from light. If the display shows is less than 20,000 ohms, unplug the cad cell, if the display does not read 999999 ohms, replace control, if it does read 999999 ohms, replace cad cell. - Expose the cad cell to ambient light (generally enough light to read by is adequate) If the display shows more than 2000 ohms, short the cad cell terminals, if the display shows more than 5 ohms, replace control, if less than 5 ohms, replace cad cell. If the burner still does not light, proceed to "No Ignition", ErP 20 corrective action.
ErP 9	No Ignition, Check Cad Cell	The burner lit very late during the trial for ignition and is susceptible to not lighting. - Check cad cell for proper alignment and clean if necessary. - Check burner adjustments (refer to burner manufacturers instructions) - Check electrodes and spring contacts (if equipped) and adjust per manufacturers recommendations. - Check if the pump is generating adequate pressure. - Check the fuel supply lines and filter for obstructions.
ErP 10	No Ignition, Check Ignition Transformer	The burner was not lit and spark was not detected. Check the electrodes, spring contacts (or high voltage wires), and ignition transformer for proper operation. If spark ignition is functioning acceptably, proceed to "No Ignition", ErP 20 corrective action.
ErP 18	Internal Error, Electronics Failure	The Erp 18 display may indicate any one of the following: Check Oil Primary and Option Panel Displays: - If Option Panel display shows "Err 3", IQ Option Card Communication Error: the ErP 18 error is caused by the option card. Replace defective card if error persists - If The Oil Primary is locked out with "Internal Error" replace control if the error persists.
ErP 20	No Ignition	- Check that fuel tank is not empty. - Check that the manual shut off valve is open. - Check that the burner motor is spinning and the pump is generating adequate pressure. - Check the condition of the nozzle and replace if necessary. - If a valve is present, check for proper operation. - Check burner adjustments (refer to burner manufacturers instructions)
ErP 21	No Ignition, After Flame Loss During Run	- Check for excessive airflow or draft causing flame to leave burner head. - Check for back pressure causing flame to be erratic. Re-ignition Failure, Flame was lost and could not be relit .
ErP 22	Flame Lost During Run Three Times In A Row	Flame was lost more than the allowed number of times. The burner lights, but does not remain lit. - Check that the fuel tank is not empty. - Check the condition of the nozzle and replace, if necessary. - Check the fuel supply lines (and filter) for obstructions or air - Use the pump priming feature to purge the system of air - Check the burner motor is spinning and the pump is generating adequate pressure. If present, check operation of the oil valve. If the problem persists, proceed to the "Cad Cell, High During Run", ErP 4 corrective action.

XIII. TROUBLE SHOOTING (continued)

E. USE BOILER CONTROL DISPLAY Err AND ErP NUMBERS TO DIRECT TROUBLESHOOTING (continued)

TABLE 15B: EXTERNAL DEVICE (Oil Primary, Option Card, etc.) ERROR NUMBER (continued)

Display	Status	Recommended Corrective Actions
ErP 23	Flame Out of Sequence, During Pre-Purge	Flame was proven during the valve on delay period. Check the oil valve for proper operation. If the system does not have an oil valve, set the valve on delay to 0.
ErP 24	Flame Out of Sequence, During Post-Purge	Flame remained lit during the burner off delay. Check the oil valve for proper operation. If the system does not have an oil valve, set the burner off delay to 0.
ErP 25	Manual Reset Required	Check Oil Primary and Option Panel Displays: - If Option Panel display shows "OL- ", Open Limit: the display will indicate the card that has a manual reset lockout. Follow instructions included with card to reset the lockout. - If The Oil Primary is locked out refer to ErP 20 for additional information.
ErP 34	CAD Ohms Permanently Low (flame out of sequence)	The cad cell is permanently in a low resistance state. It should typically read much higher than 20,000 ohms when no flame is present. - Set the display to display cad cell resistance. - Shield the cad cell from light If the display shows less than 20,000 ohms, unplug the cad cell, If display does not read 999999 ohms, replace control, If it does read 999999 ohms, replace cad cell.
ErP 53	Outdoor Air Reset Option Card, Sensor Failure	Temperature sensor or interface failure (open or short connection or increased connection resistance) or control hardware failure.
ErP 58	AC Line Frequency Error	Check power supply.
ErP 59	AC Line Voltage Error	Supply voltage is low to the control. Measure the voltage across screw terminals "2" and "3" If it's greater than 22VAC and the error does not clear, replace control. If it's less than 22VAC, review appliance wiring.
ErP 84	LWCO Option Card, Low Water Event	Low water level Limit has caused the boiler to shutdown. Make sure that the water level has reached the probe. Limit will re-close automatically after water level is restored.
ErP 89	Outdoor Air Reset Option Card, Communications Error	Loose wire between the Option Panel and Boiler Control or control failure.
ErP 91	Communication Error	Communications error has been detected. Remove all devices from the Enviracom connections, 3-pin plug and screw terminals "1-2-3". If the error does not clear within one minute, measure the voltage on terminals "2" and "3". If the voltage across terminals "2" and "3" is between 20VAC and 30VAC, replace control. If it is outside of that range, review boiler wiring. There should be approximately 24VAC across "2" and "3".
ErP 119	Aquastat Option Card, Sensor Failure	Temperature sensor or interface failure (open or short connection or increased connection resistance, dual sensor mismatch) or control hardware failure.
ErP 140	LWCO Option Card, Low Probe Signal	Warning, level monitoring signal is low. The probe may be dirty. Fluxes or oils used during the construction of the boiler or installation of system piping can coat the probe, preventing signals from being received by the LWCO Option Card. Add a cleaning solution, (such as water and tri-sodium phosphate or consult the boiler manufacturer), to the system. Heat and circulate this solution for at least one hour before draining and completely flushing the system with clean water. Remove the probe and thoroughly wipe it with a clean rag. Refill the system and test for proper operation.
ErP 141	LWCO Option Card, Manual Reset Lockout	A manual reset, low water limit has caused the boiler to shutdown. Make sure that the water level has reached the probe. Limit will NOT re-close automatically after water level is restored. To reset the control follow the LWCO Option Card Reset Pushbutton procedure.

XIII. TROUBLE SHOOTING (continued)

F. USE BOILER CONTROL DISPLAY StA (STATUS) NUMBER TO GUIDE TROUBLESHOOTING

The Boiler Control will flash "StA" followed by a number. Use this number to identify the boiler problem in the table below:

1. Burner and Circulator Off

Display / Status	Recommended Corrective Action
StA 1 Standby Burner off Circulator off	The boiler has not detected a call for heat (hr = oFF and dh = oFF). Ensure there is power to the boiler control. Check the thermostat: - When a thermostat call for heat is detected boiler control display "hr" will show "on" - Make sure thermostat is calling for heat and contacts (including appropriate zone controls) are closed. Check for loose connection. Check the DHW demand: - When a domestic call for heat is detected boiler control display "dh" will show "on" - Make sure the DHW aquastat contact is closed. Check for loose connection.

2. Circulator is On, But Burner is Off

Display / Status	Recommended Corrective Action
StA 1 Circulator Pre-purge Burner off Circulator on	The boiler is warm and circulator is providing residual boiler heat to building: Check boiler temperature - The boiler will not start until boiler water temperature is less than the Setpoint (SP) minus differential (dF) - If boiler water temperature is higher than Start Temperature (St_, default = 140 F) and the Circulator Pre-purge (PP_, default = 2 minutes) time has not expired, boiler start will be delayed until water temperature drops or time expires. To permit the boiler to start sooner increase Start Temperature parameter. Refer to Operation Section for additional information.

3. Burner is On, But Circulator is Off

Display / Status	Recommended Corrective Action
StA 8 Burner on Circulator off	Domestic Hot Water (DHW) Priority Forcing Circulator Off - When there is a DHW heat request wired to the boiler control's ZR terminal the System Circulator will be "forced off" for the duration of the DHW heat request. When the DHW heat request ends the System Circulator "force off" is removed, the circulator can respond normally. When the Priority Time, (Pt_) Parameter is set to "oFF" the System Circulator is not "forced off" for a DHW call for heat. - When there is DHW heat request and an Outdoor Air Reset IQ Card is installed the System Circulator will be forced off for the duration of the Reset Card's Priority Time (Pt_) parameter. Check Priority Time (Pt_) parameter using the Outdoor Air Reset IQ Option Card Adjustment Mode (see Reset Card Adjustment Mode Instructions). Wiring / Circulator Issue: - Check wiring for loose connection, miswiring - Check circulator

4. Circulator is On, But Oil Primary is in Standby

Display / Status	Recommended Corrective Action
StA 15 Limit Open	Heat Request occurs and start of operating sequence is halted due to an open limit. Open limits may include Auxiliary High Limit or Low Water Cut-off Cards (when installed). If Boiler Control shows "StA 15" proceed to Paragraph F.

F. USE BOILER CONTROL DISPLAY StA (STATUS) NUMBER TO GUIDE TROUBLESHOOTING (continued)

5. Burner will not come on

Display / Status	Recommended Corrective Action
StA 14 Hard Lockout Also indicated by flashing green light on R7184 Oil Primary or "Hard Lockout" message on R7284 Oil Primary	When a hard lockout occurs the burner shuts down and will not restart until the Oil Primary's manual reset button is pressed. The Oil Primary will enter the Hard Lockout mode when the burner fails to light, loses flame during run three times or senses flame during pre-purge or post purge. The following is a summary of corrective actions: 1. No fuel to burner - Check that the oil tank is not empty. - Check that the manual shut off valve is open. - Check fuel lines (and filter) are free of obstructions. - Check fuel lines are fully purged of air. Use the pump priming feature to purge the system of air - Check that the burner motor is spinning and the pump is generating adequate pressure. - Check operation of fuel valve. 2. Nozzle Clogged - Check the condition of the nozzle and replace if necessary. 3. No Spark - Check the electrodes, spring contacts and high voltage wires. - Check ignition transformer for proper operation 4. Air Flow Too High or Too Low - Check for excessive airflow or draft causing flame to leave burner head. - Check for back pressure causing flame to be erratic - Check for excessive soot build up in the burner and flue - Check burner adjustments (refer to burner manufacturers instructions) 5. CAD Cell Defective - Check CAD cell for proper alignment and clean if necessary - Check CAD cell operation, refer to Trouble Shooting section D's ErP 5 for procedure.

6. Burner will light, then shut down after a short time, then restart

Display / Status	Recommended Corrective Action
StA 10 Recycle / Retry Delay	The burner loses flame during running mode (StA code "8"). After a recycle delay the oil primary will attempt to light the burner again. If the burner loses flame during running mode for three times in a row a Hard Lockout, State 14 will result. Refer to Recommended Corrective Actions listed on previous page for ErP 22.

7. Flame Out of Sequence

Display / Status	Recommended Corrective Action
StA 16 Flame Out of Sequence	Flame was detected during pre-purge (valve on delay) or post purge (motor off delay). Check the following: - Check the oil valve for proper operation - Check the CAD cell, refer to trouble shooting section D's ErP 34 for additional information.

XIII. TROUBLE SHOOTING (continued)

G. USE OPTION PANEL DISPLAY TO DIRECT TROUBLESHOOTING

If Boiler Control Shows Status Code "StA 15": The Boiler Control is "Waiting for Limit to Close and Option Panel display (display to right) will show one of the following status codes:

Option Panel Display Shows "Err"			
Display		Status	Boiler / Control Action(s)
Err	1	Low Input Voltage	AC voltage is too low
Err	2 - card #	Option Card Type Change without Re-Learn	Whenever a new Option Card is first installed into the Option Panel, the Option Panel automatically "Learns" the card. This means it detects the specific card and lists it as a card number (C1, C2, or C3). However, to help avoid errors or unauthorized option card changes, once an Option Card is initially installed, the Option Panel will not automatically "Learn" a different card in the same slot. In this situation, the Option Panel has to "Learn" about the new card manually. To have the Option Panel recognize or "Learn" about a different card, the user must press the 'M' key on the Option Panel until "Lrn" is displayed. Then press and hold either the Up ⇧ or Down ⇩ key for at least three (3) seconds. The Option Panel will then recognize and "Learn" the new Option Card.
Err	3 - card #	Option Card Communications Error	The Option Card is not installed properly or has an internal fault. Remove the card and check for bent Option Panel card interface pins. Straighten bent or misaligned pins or choose another card slot and reinstall card. If problem persists, replace card.
Err	4 - card #	Option Card Hardware Interface Error	The Option Card is not installed properly, there is a option card or Option Panel fault. Remove the card and check for bent Option Panel card interface pins. Straighten bent or misaligned pins or choose another card slot and reinstall card. If problem persists, replace card.
Err	5	Limit Output OFF in ON State	Check limit string wiring, replace the Option Panel.
Err	6	Incorrect Wiring	Check boiler wiring.
Err	7	Internal Option Panel Error	Replace the Option Panel.
Err	8	Limit Output ON in OFF State	Check limit string wiring, replace the Option Panel.
Err	9	Hard Lockout Due to Repeated Err 8	Check limit string wiring, replace the Option Panel.

If Option Panel Display Shows "OL": The OL- "card number" indicates the card slot causing the Open Limit. For example, "OL-C 1" means open limit in the card located in card slot 1. To determine the cause of the open limit the user must switch the display on the Option Panel to show the view mode of the Option Card installed in Slot 1.

For example, if, while the boiler has a Heat Request, and the Aquastat Option Card installed in Slot 1 has a sensor failure the Option Panel displays OL-C 1 (Open Limit Card Slot 1). To investigate the status of option card C 1:

1. Press the "I" key on the Option Panel. The display will go from "OL-C 1" to C 1 .
2. When the display shows C 1, press either the Up ⇧ or Down ⇩ keys to switch the display to show the view mode of the Aquastat Limit Control Option Card inserted in Slot 1. The display will now read Err 119, Sensor Failure.
3. Check the sensor connections and when required replace the sensor.
4. When the sensor failure is corrected the Option Panel will return to the "O.C.P" display and the control start sequence will continue.

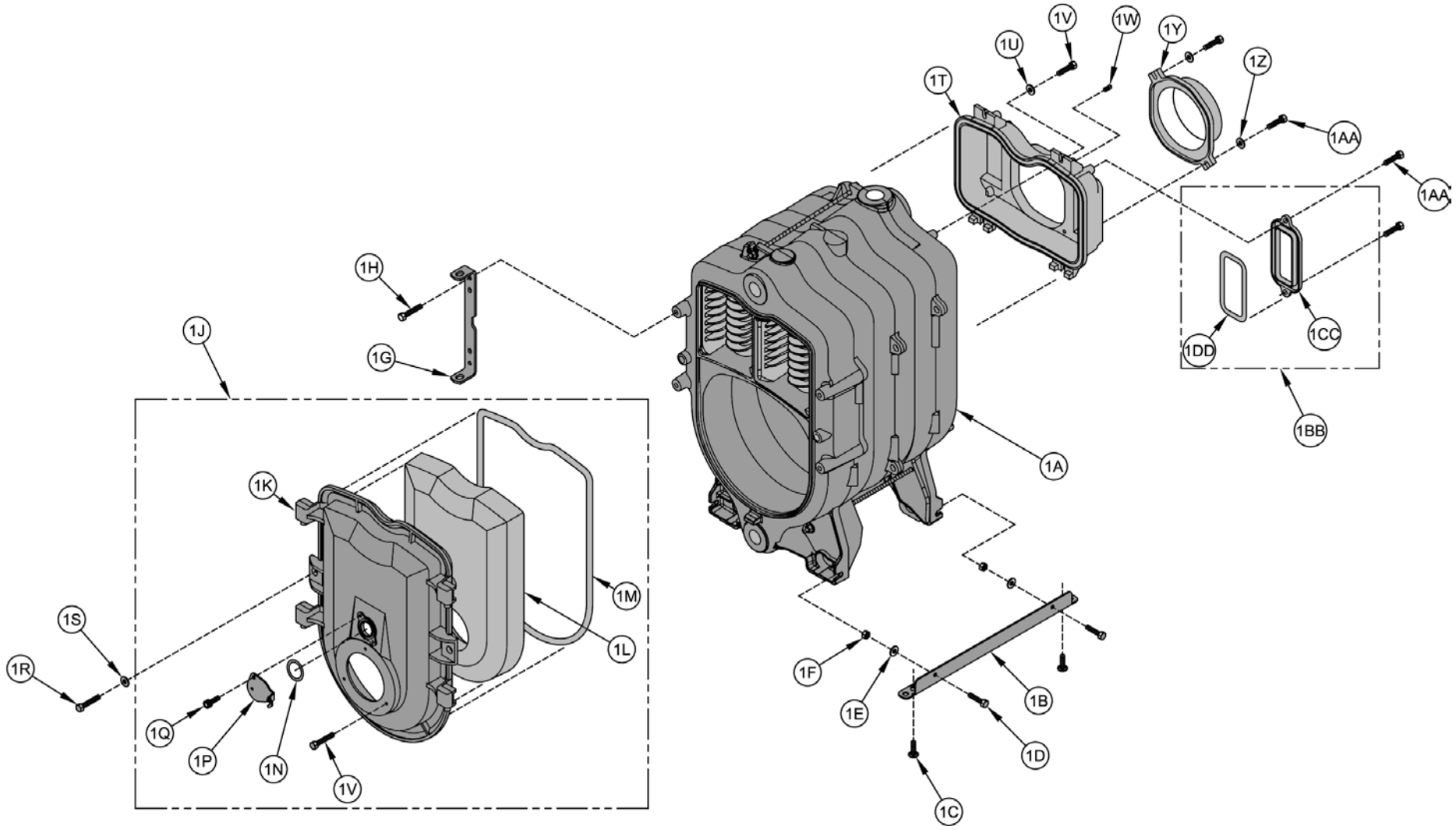
For additional information refer to the instruction manual supplied with the Option Card.

If Option Panel Display Shows "O.C.P": The Option Panel is in normal run or operating mode, the Option Panel display will show "O.C.P" (Option Card Panel) along with a floating decimal point that flashes on and off (the "heartbeat" flash indicating the panel is functioning properly and there are no open limits or errors). The Option Panel or the Option Card installed in the Option Panel are not causing the open limit.

XIV. REPAIR PARTS

All MPO-IQ™ Boiler Repair Parts may be obtained through your local U.S. Boiler Company Wholesale distributor. Should you require assistance in locating a U.S. Boiler Company Distributor in your area, or have questions regarding the availability of U.S. Boiler Company products or repair parts, please contact U.S. Boiler Company Customer Service at (717) 481-8400 or Fax (717) 481-8408.

XIV. REPAIR PARTS (continued)

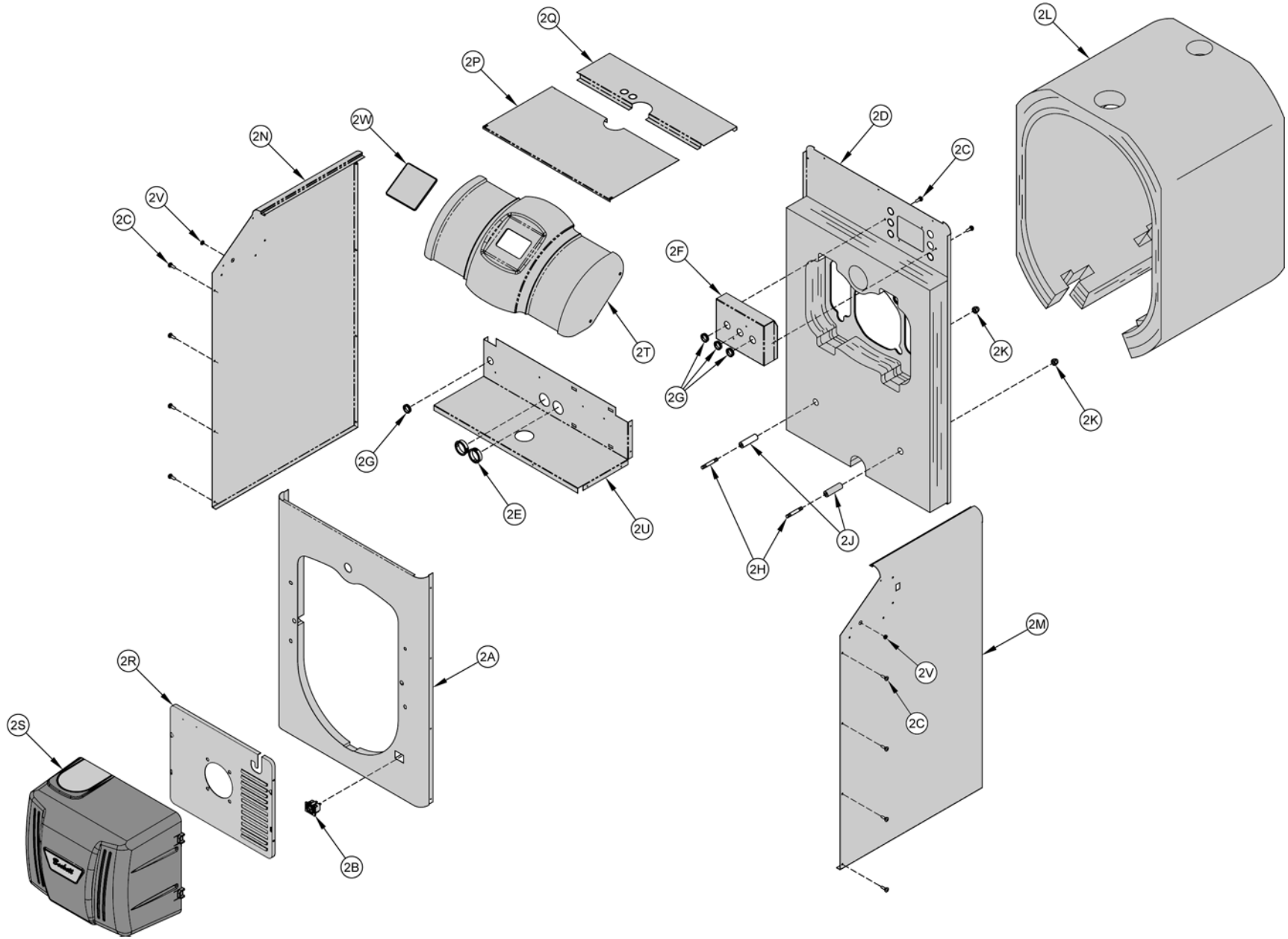


Bare Boiler Assembly

XIV. REPAIR PARTS (continued)

Item No.	Description	Part No.	MPO-IQ84	MPO-IQ115	MPO-IQ147	MPO-IQ189	MPO-IQ231
1. BARE BOILER ASSEMBLY							
1A	Cast Iron Block Assembly - 2 Section	103071-02	1	1	---	---	---
	Cast Iron Block Assembly - 3 Section	103071-03	---	---	1	---	---
	Cast Iron Block Assembly - 4 Section	103071-04	---	---	---	1	---
	Cast Iron Block Assembly - 5 Section	103071-05	---	---	---	---	1
1B	Spanner Bar w/Threaded Inserts, 1-1/4" x 1-1/2" x 14-3/8" Lg.	100012-01	2	2	---	---	---
	Spanner Bar w/Threaded Inserts, 1-1/4" x 1-1/2" x 20-3/8" Lg.	100012-02	---	---	2	---	---
	Spanner Bar w/Threaded Inserts, 1-1/4" x 1-1/2" x 26-3/8" Lg.	100012-03	---	---	---	2	---
	Spanner Bar w/Threaded Inserts, 1-1/4" x 1-1/2" x 32-3/8" Lg.	100012-04	---	---	---	---	2
1C	Carriage Bolt, 3/8"-16 x 1-1/4" Lg., Plated	100215-01	4	4	4	4	4
1D	Cap Screw, 5/16"-18 x 7/8" Lg., Plated	80861371	4	4	4	4	4
1E	Flat Washer, 5/16" USS, Plated	80860611	4	4	4	4	4
1F	Hex Nut, 5/16-18, Serrated Flange, Plated	80860443	4	4	4	4	4
1G	Hinge Bracket	100014-01	1	1	1	1	1
1H	5/16"-18 x 3/4" Lg. Cap Screw, Plated	80861340	2	2	2	2	2
1J	Cast Iron Burner Door Assembly	102417-01	1	1	1	1	---
		102417-02	---	---	---	---	1
1K	Cast Iron Burner Swing Door (Only)	102421-01	1	1	1	1	1
1L	Burner Swing Door Insulation (Less Pockets)	100039-01	1	1	1	1	---
	Burner Swing Door Insulation (With Pockets)	100039-02	---	---	---	---	1
1M	1/2" Dia. Rope Gasket - Burner Swing Door	102022-01	1	1	1	1	1
1N	1/8" Dia. Rope Gasket - Observation Port	100096-01	1	1	1	1	1
1P	Observation Port Cover	100015-01	1	1	1	1	1
1Q	5/16"-18 x 5/8" Lg. Socket Head Cap Screw, Plated	100050-01	2	2	2	2	2
1R	3/8"-16 x 1-3/4" Lg. Tap Bolt, Plated	100102-01	2	2	2	2	2
1S	3/8" Flat Washer, USS, Plated	80860618	2	2	2	2	2
1T	Smokebox	100021-01	1	1	1	1	1
1U	5/16" Flat Washer, USS, Plain	80860601	4	4	4	4	4
1V	5/16"-18 x 7/8" Lg. Cap Screw, Plain	80861340	7	7	7	7	7
1W	1/4" NPT Pipe Plug, Square Head, Brass	806603542	1	1	1	1	1
1Y	Smokebox Collar 5" Dia.	100092-01	1	1	---	---	---
	Smokebox Collar 6" Dia.	100093-01	---	---	1	1	---
	Smokebox Collar 7" Dia.	100094-01	---	---	---	---	1
1Z	5/16" Flat Washer, USS, Plated	80860611	2	2	2	2	2
1AA	5/16"-18 x 7/8" Lg. Cap Screw, Plated	80861371	6	6	6	6	6
1BB	Clean-Out Cover Assembly	100078-01	1	1	1	1	1
1CC	Cast Iron Clean-Cut Cover (only)	100104-01	2	2	2	2	2
1DD	1/2" Dia. Rope Gasket - Clean-Cut Cover	100095-01	2	2	2	2	2

XIV. REPAIR PARTS (continued)

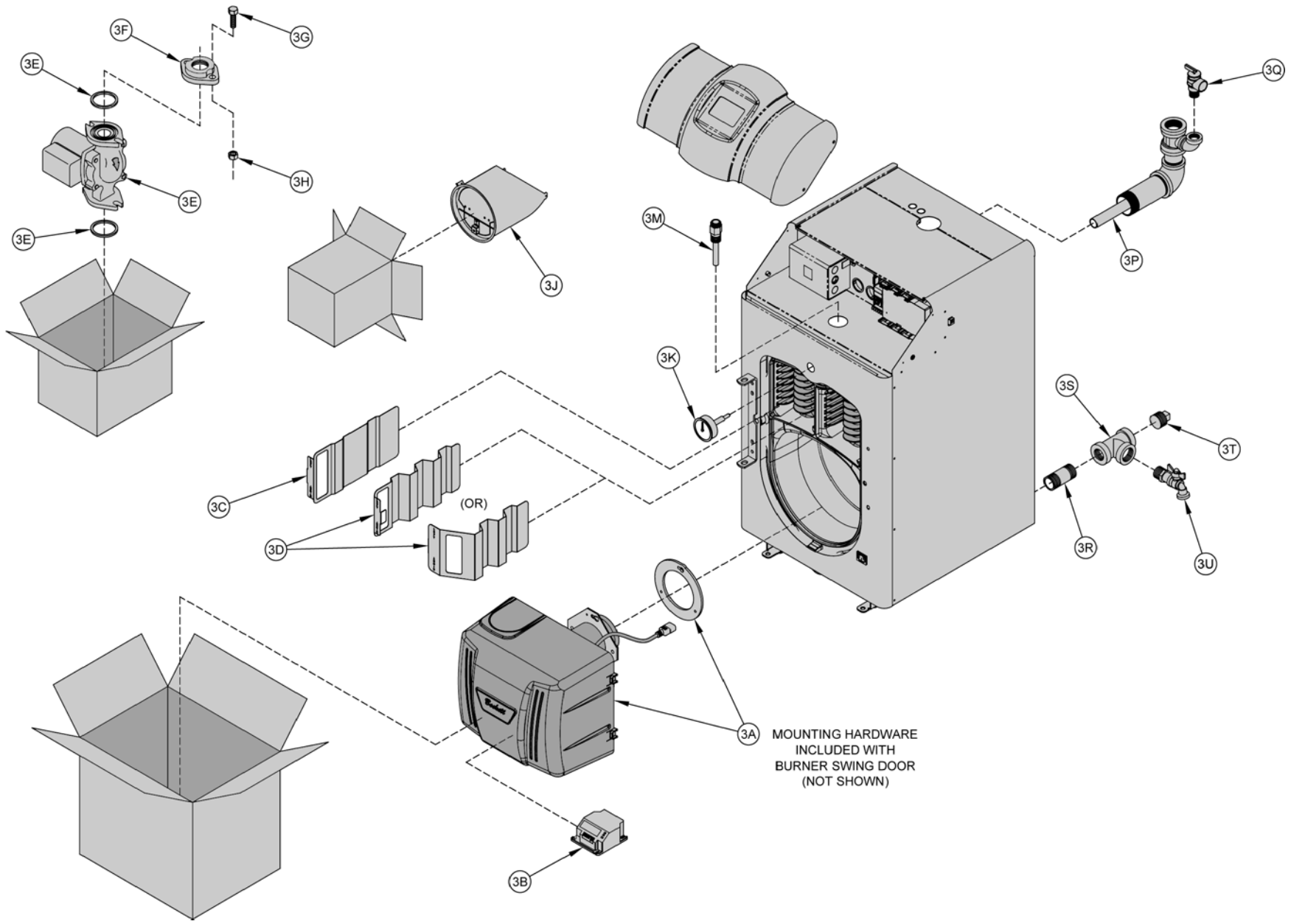


Jacket Assembly

XIV. REPAIR PARTS (continued)

Item No.	Description	Part No.	MPO-IQ84	MPO-IQ115	MPO-IQ147	MPO-IQ189	MPO-IQ231
2. JACKET ASSEMBLY							
2A	Jacket Front Panel Assembly w/Insulation	103053-01	1	1	1	1	1
2B	Power Outlet Receptacle, Heyco #0937	8136522	1	1	1	1	1
2C	#8 x 1/2" Sheet Metal Screw, Black Oxide	80860061	33	33	33	33	33
2D	Jacket Rear Panel Assembly w/Insulation	103054-01	1	1	1	1	1
2E	Snap Bushing, Heyco #2240	102338-01	2	2	2	2	2
2F	Internal Junction Box	102550-01	1	1	1	1	1
2G	Snap Bushing, Heyco #2126	102285-01	4	4	4	4	4
2H	5/16" -18 x 3" Lg. Tap End Stud, Plain	100046-01	2	2	2	2	2
2J	5/8" O.D. x 2-5/32" Lg. Jacket Spacer	100035-01	2	2	2	2	2
2K	5/16" -18 Acorn Nut, Plated	100047-01	2	2	2	2	2
2L	3" Thick Fiberglass Insulation Wrapper For:						
	2 Section Cast Iron, Block Assembly	100016-01	1	1	---	---	---
	3 Section Cast Iron, Block Assembly	100016-02	---	---	1	---	---
	4 Section Cast Iron, Block Assembly	100016-03	---	---	---	1	---
	5 Section Cast Iron, Block Assembly	100016-04	---	---	---	---	1
2M	Jacket Right Side Panel Assembly (No Insulation Required)						
	2 Section Boiler	103049-02	1	1	---	---	---
	3 Section Boiler	103049-03	---	---	1	---	---
	4 Section Boiler	103049-04	---	---	---	1	---
	5 Section Boiler	103049-05	---	---	---	---	1
2N	Jacket Left Side Panel Assembly (No Insulation Required)						
	2 Section Boiler	103048-02	1	1	---	---	---
	3 Section Boiler	103048-03	---	---	1	---	---
	4 Section Boiler	103048-04	---	---	---	1	---
	5 Section Boiler	103048-05	---	---	---	---	1
2P	Jacket Top Panel Assembly (No Insulation Required)						
	2 Section Boiler	103050-02	1	1	---	---	---
	3 Section Boiler	103050-03	---	---	1	---	---
	4 Section Boiler	103050-04	---	---	---	1	---
	5 Section Boiler	103050-05	---	---	---	---	1
2Q	Jacket Top Rear Panel Assembly (No Insulation Required)	103051-01	1	1	1	1	1
2R	Beckett Burner Plastic Enclosure Backer Plate	102233-01	1	1	1	1	1
2S	Beckett Burner Plastic Enclosure Cover	102232-01	1	1	1	1	1
2T	Jacket Poly Front Cover	102600-06	1	1	1	1	1
2U	Control Panel	103052-01	1	1	1	1	1
2V	Snap Bushing, Heyco #2043	8136048	2	2	2	2	2
2W	MPO-IQ Logo Plate	102502-04	1	1	1	1	1

XIV. REPAIR PARTS (continued)



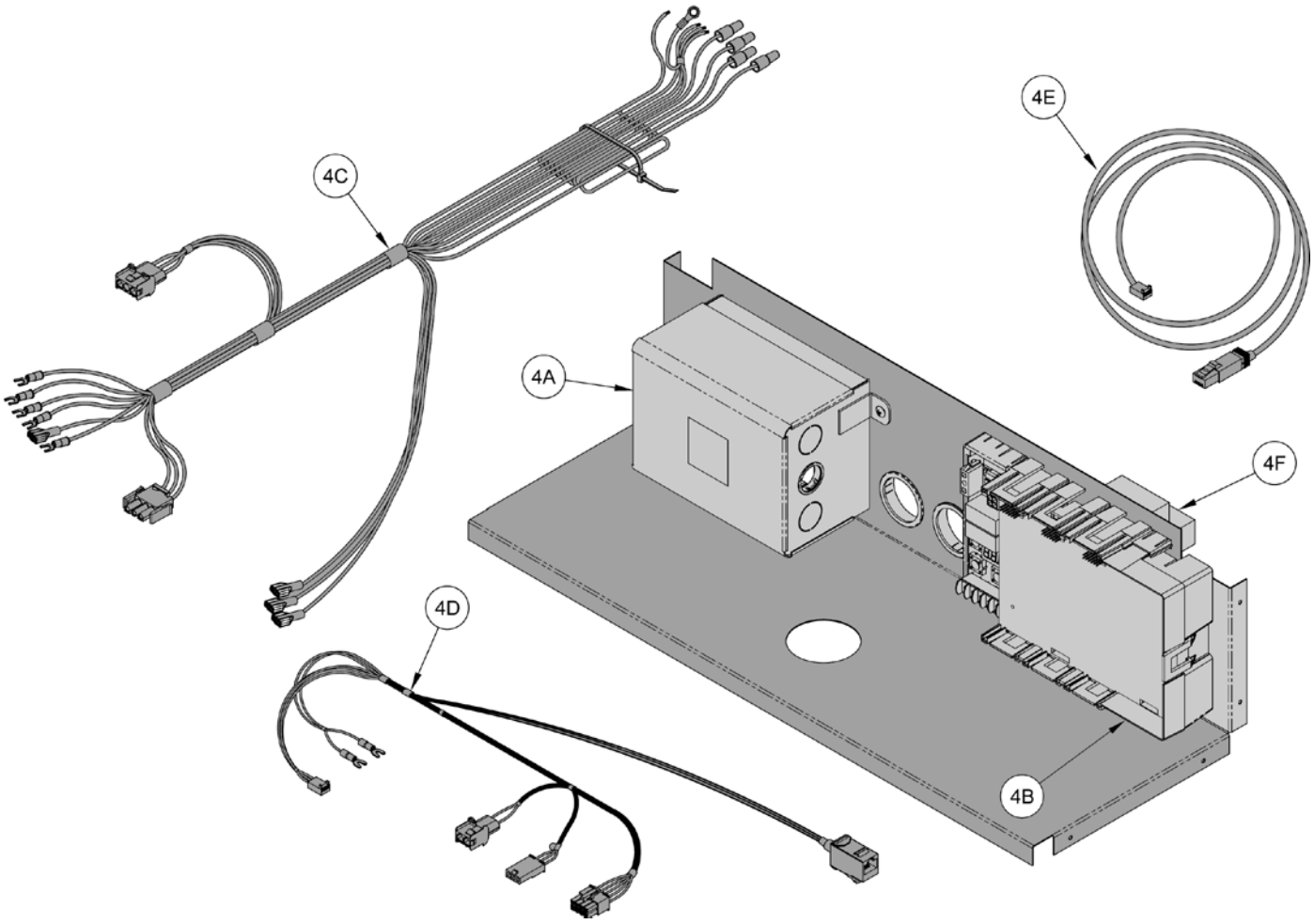
MPO-IQ84 Thru MPO-IQ231 Water Boilers - Trim and Controls

XIV. REPAIR PARTS (continued)

Item No.	Description	Part No.	MPO-IQ84	MPO-IQ115	MPO-IQ147	MPO-IQ189	MPO-IQ231
3. MPO-IQ84 Thru MPO-IQ231 WATER BOILERS - TRIM AND CONTROLS							
3A	**Beckett AFG Oil Burner w/Gasket for: Natural Draft**						
	MPO-IQ84 Spec No. BCB7702	100052-01	1	---	---	---	---
	MPO-IQ115 Spec No. BCB7707	102065-01	---	1	---	---	---
	MPO-IQ147 Spec No. BCB7703	100053-01	---	---	1	---	---
	MPO-IQ189 Spec No. BCB7704	100054-01	---	---	---	1	---
	MPO-IQ231 Spec No. BCB7705	100055-01	---	---	---	---	1
	Beckett NX Oil burner w/Gasket for: Direct Vent						
	Spec No. BCB7903	100240-02	---	---	1	---	---
	Spec No. BCB7904	100240-03	---	---	---	1	---
	Spec No. BCB7905	100240-04	---	---	---	---	1
	Riello 40 Oil Burner w/Gasket for: Natural Draft						
	MPO-IQ84 Spec No. C8511151	103143-01	1	---	---	---	---
	MPO-IQ115 Spec No. C8511170	103143-02	---	1	---	---	---
	MPO-IQ147 Spec No. C8512478	100831-01	---	---	1	---	---
	MPO-IQ189 Spec No. C8512487	101762-01	---	---	---	1	---
	MPO-IQ231 Spec No. C8512488	101763-01	---	---	---	---	1
	Carlin EZ Oil Burner w/Gasket for: Natural Draft						
	MPO-IQ84 Spec No. 99888M8	102276-01	1	---	---	---	---
	MPO-IQ115 Spec No. 9988811M11	102276-02	---	1	---	---	---
	MPO-IQ147 Spec No. 9985811J14	102276-03	---	---	1	---	---
	MPO-IQ189 Spec No. 9985811J18	102276-04	---	---	---	1	---
	MPO-IQ231 Spec No. 9985811J23	102276-05	---	---	---	---	1
	(Note: See Pages 78 thru 81 for Beckett Burner Parts Breakdown)						
3B	Oil Primary Control, Honeywell R7284P1080 (Universal)	103880-01	1	1	1	1	1
3C	Stainless Steel Third Pass Flueway Baffle	100081-01	2	2	---	---	--
3D	Stainless Steel Second Pass Flueway Baffle	100042-01	---	---	2	2	2
		102066-01	---	2	---	---	---
3E	Circulator w/ Gaskets — Taco 007	8056170	1	1	1	1	1
	Circulator w/ Gaskets — Bell & Gossett NRF22	8056174					
	Circulator w/ Gaskets — Grundfos UP15-42F	8056173					
3F	Circulator Flange, 1-1/2" NPT	806602014	2	2	2	2	2
3G	Cap Screw, Hex Head, 7/16" -14 x 1-1/2" Lg.	80861301	4	4	4	4	4
3H	Hex Nut, 7/16" -14	80860406	4	4	4	4	4
3J	5" RC-STD Draft Control	8116287	1	1	---	---	---
	6" RC-STD Draft Control	8116288	---	---	1	1	---
	7" RC-STD Draft Control	8116289	---	---	---	---	1
3K	Temperature & Pressure Gauge, 3-1/4" Dia., ENFM #4104-3-1/4-1/4-10 CHR	100282-01	1	1	1	1	1
3M	Honeywell #123869A Immersion Well, 1/2" NPT x 1-1/2" Insulation	80160456	1	1	1	1	1
3P	Return Injector Kit	102827-01	1	1	1	1	1
	Miscellaneous Parts Bag Assembly - (Note) Includes Items 3Q thru 3V	100098-01	1	1	1	1	1
3Q	Relief Valve, 3/4" NPT M x F, Conbraco #10-407-05 — 30 PSI	81660363	1	1	1	1	1
	Relief Valve, 3/4" NPT F x F, Conbraco #10-303-07 — 40 PSI	81660370*					
	Relief Valve, 3/4" NPT F x F, Watts #374A-50 — 50 PSI	103837-01*					
3R	Nipple, 1-1/4" NPT x 5" Lg.	100090-01	1	1	1	1	1
3S	Tee, 1-1/4" x 1-1/4" x 3/4" NPT	806601032	1	1	1	1	1
3T	Pipe Plugs 1-1/4" NPT	806603502	1	1	1	1	1
3U	Drain Valve, 3/4" NPT, Conbraco #35-302-03	806603061	1	1	1	1	1

* 3/4" NPT close pipe nipple must be field supplied for installation of this valve

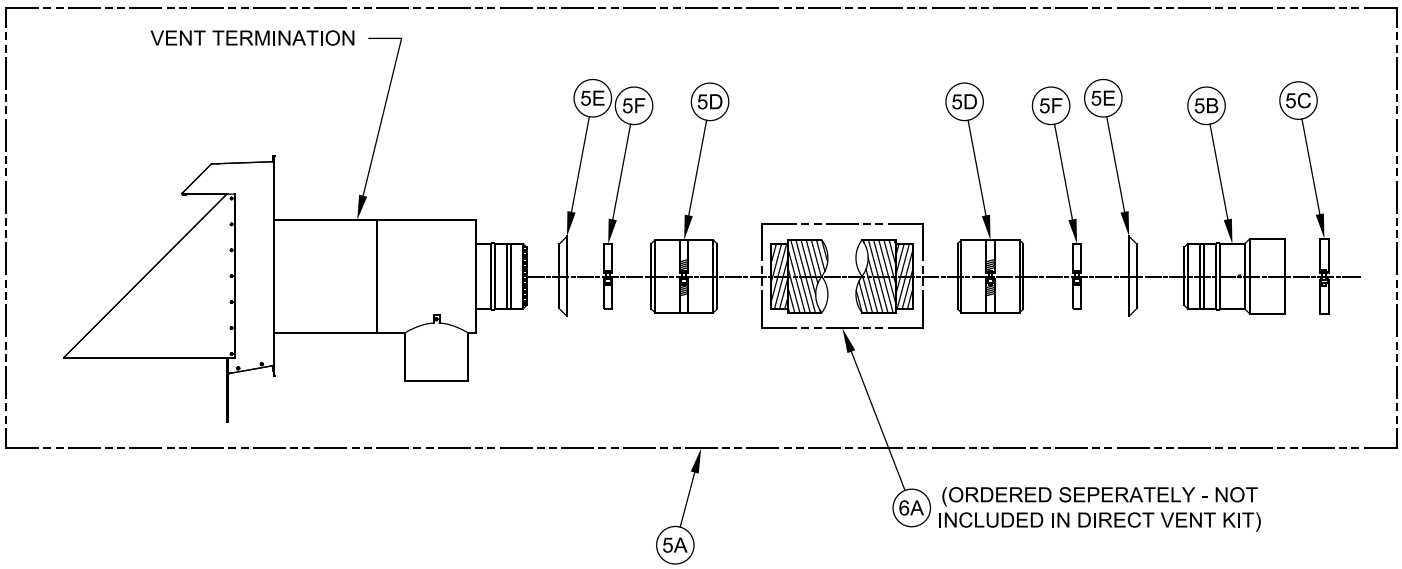
XIV. REPAIR PARTS (continued)



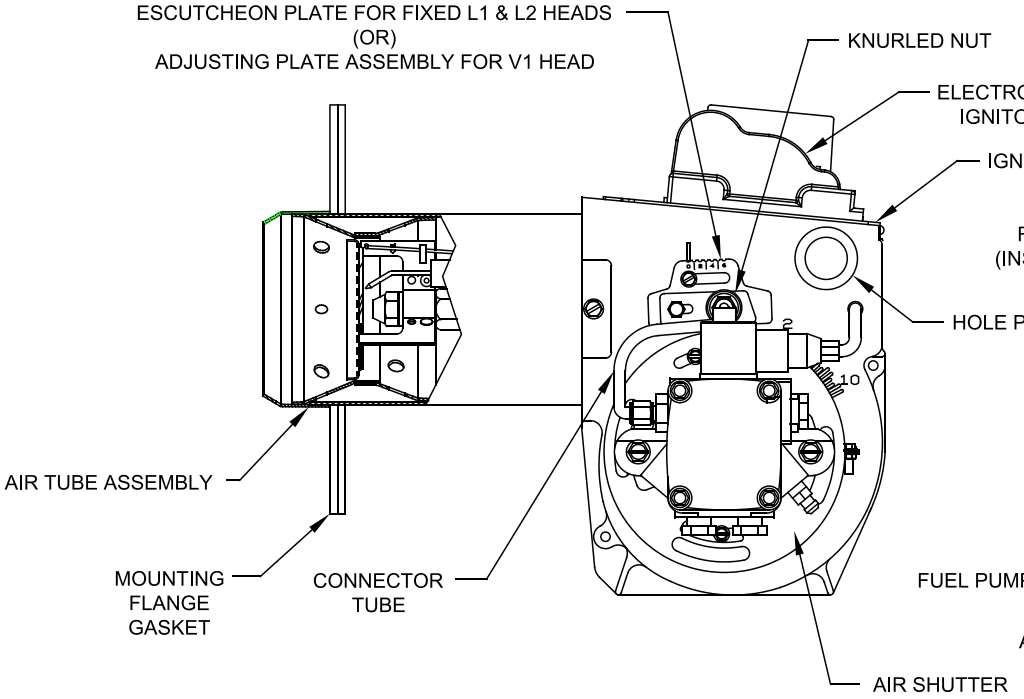
Item No.	Description	Part No.	MPO-IQ84	MPO-IQ115	MPO-IQ147	MPO-IQ189	MPO-IQ231
4. CONTROLS							
4A	IQ Oil Boiler Control	103851-01	1	1	1	1	1
4B	IQ Option Control Panel	102291-01	1	1	1	1	1
4C	Line Voltage Harness	103058-02	1	1	1	1	1
4D	Low Voltage Harness	103059-03	1	1	1	1	1
4E	Burner-ECOM Harness	103060-02	1	1	1	1	1
4F	Transformer	102516-01	1	1	1	1	1
Not Shown	Limit Rated Temperature Sensor, 12" Length (Honeywell 50001464-001)	103195-01	1	1	1	1	1

XIV. REPAIR PARTS (continued)

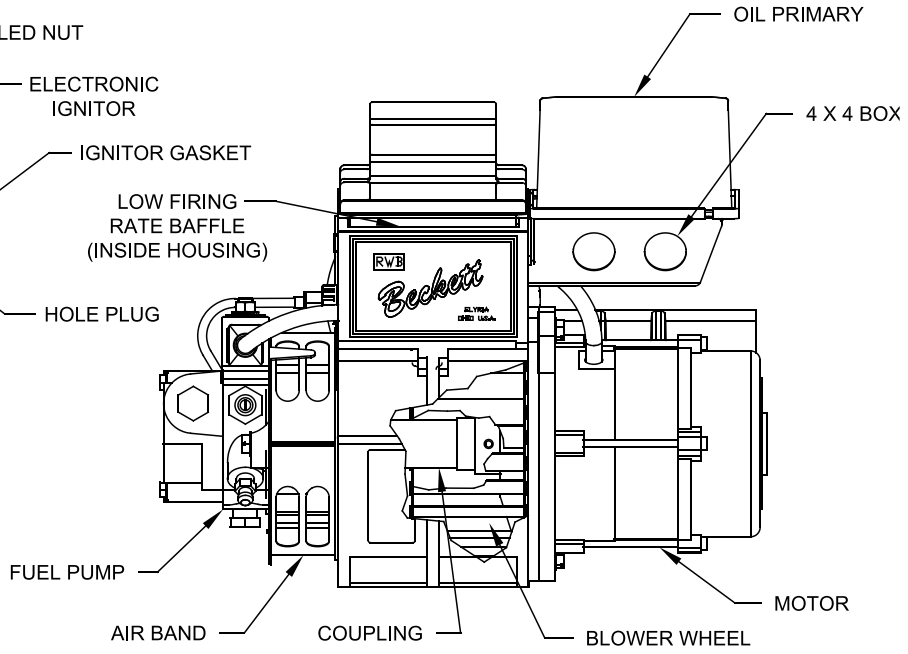
Item No.	Description	Part No.	MPO-IQ147	MPO-IQ189	MPO-IQ231
5. DIRECT VENT KITS AND PARTS					
5A	Direct Vent Conversion Kit , 5-6	102130-02	1	1	---
	Direct Vent Conversion Kit, 6-7	102130-03	---	---	1
5B	Appliance Adapter, FDVS, 5-6	100234-02	1	1	---
	Appliance Adapter, FDVS, 6-7	100234-03	---	---	1
5C	6" Appliance Clamp, FDVS-6, Half	100235-02	2	2	---
	7" Appliance Clamp, FDVS-7, Half	100235-03	---	---	2
5D	Cover Sleeve Assembly, FDVS-5	100236-02	2	2	---
	Cover Sleeve Assembly, FDVS-6	100236-03	---	---	2
5E	Cover Ring Assembly, FDVS-5	100237-02	2	2	---
	Cover Ring Assembly, FDVS-6	100237-03	---	---	2
5F	Inner Pipe Clamp, FDVS-5, Half	100238-02	4	4	---
	Inner Pipe Clamp, FDVS-6, Half	100238-03	---	---	4
6. FLEX OIL VENT PIPE					
6A	5" Dia. x 5 ft. FOVP-505	100211-02	1	1	---
	5" Dia. x 10 ft. FOVP-510	100212-02			
	5" Dia. x 15 ft. FOVP-515	100213-02			
	5" Dia. x 20 ft. FOVP-520	100214-02			
	6" Dia. x 5 ft. FOVP-605	100211-03	---	---	1
	6" Dia. x 10 ft. FOVP-610	100212-03			
	6" Dia. x 15 ft. FOVP-615	100213-03			
	6" Dia. x 20 ft. FOVP-620	100214-03			



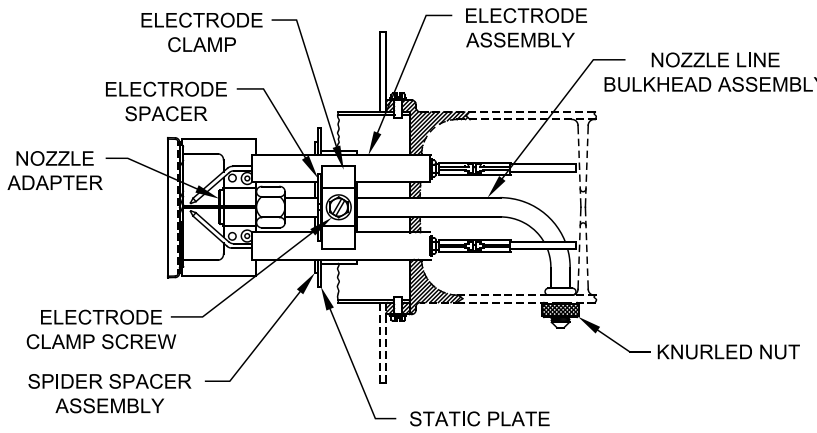
XIV. REPAIR PARTS (continued)



SIDE VIEW



FRONT VIEW



NOZZLE DETAIL

Beckett AFG Burner

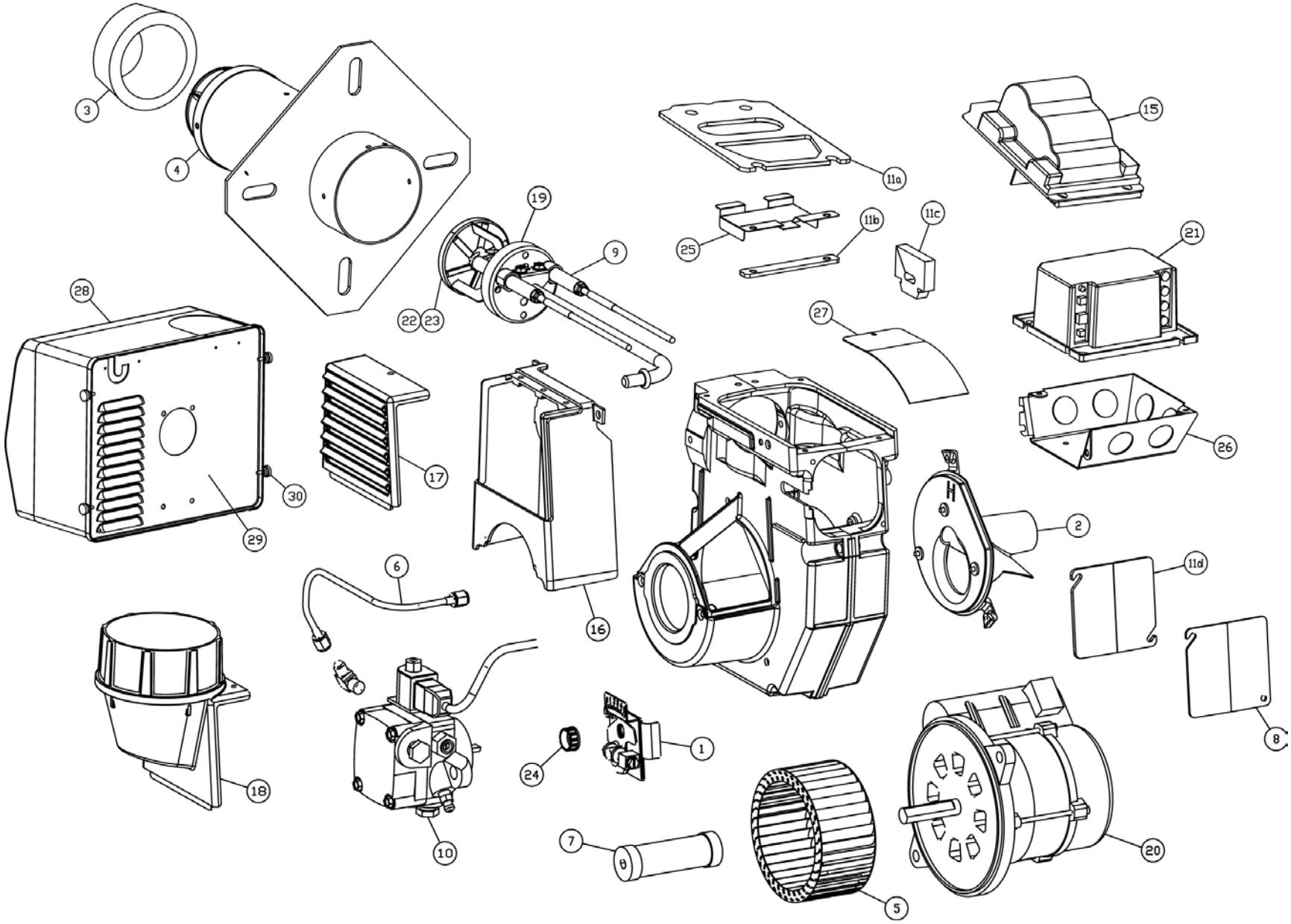
XIV. REPAIR PARTS (continued)

BECKETT AFG OIL BURNER PART NOS. FOR MPO-IQ SERIES BOILERS NATURAL DRAFT APPLICATIONS

NOTE: When ordering parts always give the serial and model numbers shown on the boiler and burner. Also provide the name of the part(s) and part number as listed below.

Boiler Model	MPO-IQ84	MPO-IQ115	MPO-IQ147	MPO-IQ189	MPO-IQ231
Air Tube Combination	AFG70MQASN	AFG70MPASN	AFG70MMAQN	AFG70MLASN	AFG70MKASN
Beckett's Spec. No.	BCB7702	BCB7707	BCB7703	BCB7704	BCB7705
Air Band	31840	31840	3492	3492	3492
Air Band Nut	4150	4150	4150	4150	4150
Air Band Screw	4198	4198	4198	4198	4198
Air Shutter	3709	3709	3709	3709	3709
Air Shutter Screw	4198	4198	4198	4198	4198
Blower Wheel	2999	2999	2999	2999	2999
Coupling	2454	2454	2454	2454	2454
Low Firing Rate Baffle	3708	---	---	---	---
Bulkhead Knurled Locknut	3666	3666	3666	3666	3666
Connector Tube Assembly	5636	5636	5636	5636	5636
Electrode Clamp	149	149	149	149	149
Electrode Clamp Screw	4219	4219	4219	4219	4219
Electrode Insulator Assembly	5780	5780	5780	5780	5780
Spider Spacer Assembly	5503	5503	5503	5503	5503
Escutcheon Plate	3493	3493	3493	5941	5941
Adjusting Plate Assembly	---	---	---	5941	5941
Head	51895	51895	5912	5913G	5913G
Head Screws	4221	4221	4221	4221	4221
Flange Gasket	32388	32388	32388	32388	32388
AFG Housing	5874	5874	5874	5874	5874
Motor	21805	21805	21805	21805	21805
Nozzle Adapter	213	213	213	213	213
Nozzle Line Electrode Assembly	NL70MB	NL70MB	NL70MM	NL70MD	NL70MD
Oil Pump, Clean Cut (Single Stage)	2184404U	2184404U	2184404U	2184404U	2184404U
Oil Pump, Clean Cut (Two-Stage)	51975U	51975U	51975U	51975U	51975U
Static Plate	3384	3383	3384	---	31905P
Ignitor	51771U	51771U	51771U	51771U	51771U
Ignitor Hinge Screw	4217	4217	4217	4217	4217
Ignitor Holding Screw	4292	4292	4292	4292	4292
Ignitor Gasket Kit	51304	51304	51304	51304	51304
Wire Guard	10251	10251	10251	10251	10251
Junction Box	5770	5770	5770	5770	5770
Flame Detector	7006	7006	7006	7006	7006
Oil Solenoid Valve Coil	21775U	21775U	21775U	21775U	21775U
Oil Solenoid Valve Cord	21807	21807	21807	21807	21807

XIV. REPAIR PARTS (continued)



Beckett NX Burner

XIV. REPAIR PARTS (continued)

BECKETT NX OIL BURNER PART NOS. FOR MPO-IQ SERIES BOILERS DIRECT VENT APPLICATIONS

NOTE: When ordering parts always give the serial and model numbers shown on the boiler and burner. Also provide the name of the part(s) and part number as listed below.

Item No.	Part Description	MPO-IQ147	MPO-IQ189	MPO-IQ231
		Beckett Part Numbers		
	Complete Oil Burner (without Primary Control)	BCB7903	BCB7904	BCB7905
1	Air Adjustment Mechanism Assembly	51794U		
2	Air Guide	101101U		
3	Heat Shield (where used/optional)	Specify		
4	Air Tube Combination	NX70LB	NX90LD	
	Air Tube Mounting Screws #8 x 3/8"	4396		
5	Blower Wheel	29994U		
6	Connector Tube Assembly, 11"	51127		
7	Coupling	2454		
8	Rear Access Door	32119U		
9	Electrodes Insulator Kit	51811U		
10	Fuel Unit, Single Stage, A2EA6520N621L	2184404U		
	Fuel Unit, Two Stage	51975U		
	Mounting Screws 1/4 -20 x 7/8"	4189		
11a	Gasket, Igniter Baseplate	51942U		
11b	Gasket, Igniter Baseplate Hinge			
11c	Gasket, Wiring			
11d	Gasket, Rear Access Door			
15	Igniter, Electronic	51771U		
16	Inlet Air Box	1010U		
18	Inlet Air Adapter, Outside Air Kit	1014U		
19	Nozzle Line Electrode and Head Assembly	Specify		
20	Motor	21805U		
	Mounting Screws 1/4 -20 x 7/8"	4189		
21	Oil Primary (Safety Control)	Specify		
22	Retention Head Assembly - 6 Slot	51785U		
23	Retention Head Assembly - 9 Slot	51815U		
24	Splined Nut	3666		
25	Spring, Igniter Prop	32058PU		
26	Wiring Box	5770		
27	Low Firing Rate Baffle (If applicable)	32229U		
28	Cover, Burner	51812U		
29	Mounting Plate, Burner Cover	32103U		
30	Thumbscrews, Cover Mounting	21899U		
Not Shown	Gasket, Flange	32087		
	Main Housing Assembly	51783		
	Nozzle Line Heater (If applicable)	51621		

XIV. REPAIR PARTS (continued)

RIELLO OIL BURNER PART NUMBERS FOR MPO-IQ SERIES BOILERS

NOTE: When ordering parts always give the serial and model numbers shown on the boiler and burner.

Refer to Models F3 & F5 Installation Manual, Riello 40 Series Residential Oil Burners (C6501010) or Model F10 Installation Manual, Riello 40 Series Residential Oil Burners (2902554) for an exploded view of the burner and a list of spare parts.

For replacement Riello oil burner parts, contact your wholesaler or the burner manufacturer:

Riello Corporation of America
35 Pond Park Road
Hingham, Massachusetts 02043
Telephone: (617) 749-8292
Facsimile: (617) 740-2069
Toll Free: (outside Massachusetts)
(800) 992-7637

Riello Canada Inc.
2165 Meadowpine Blvd.
Mississauga, Ontario L5N 6H6
Telephone: (905) 542-0303
Facsimile: (905) 542-1525
Toll Free: (800) 387-3898

CARLIN OIL BURNER PART NUMBERS FOR MPO-IQ SERIES BOILERS

NOTE: When ordering parts always give the serial and model numbers shown on the boiler and burner.

Refer to *Installation and Operating Instructions for Packaged Heating/Burner Units, Carlin Elite EZ-LF and EZ-66 Oil Burners* (Form CCT-569A) for an exploded view of the burner and a list of spare parts.

For replacement Carlin oil burner parts, contact your wholesaler or the burner manufacturer:

CCT, Carlin Combustion Technology, Inc.
70 Maple Street
East Longmeadow, MA 01028
Telephone: (413) 525-7700
Facsimile: (413) 525-8306

XV. BURNER SPECIFICATIONS

TABLE 16A: BECKETT AFG BURNER SPECIFICATIONS - CHIMNEY VENT

Boiler Model	Burner Input (GPH)	Burner Model	Nozzle	Air Shutter (setting)	Air Band (setting)	Pump Pressure (PSI)	Head Type (setting)	Insertion Depth (Inch)	Approx. Shipped CO_2 (%)	Baffle Location (pass)	Approx. Stack Temp. Increase Without Baffles °F [2]	Approx. Breech Pressure (" w.c.) [3]	Baffles IN Approx. Overfire Pressure (" w.c.) [3]	Baffles OUT Approx. Overfire Pressure (" w.c.) [3]
MPO-IQ84	0.60	AFG	0.50 x 45W Delavan	6 [1]	0	150	L2	2	11.5	3rd	52	0	+0.010	+0.005
MPO-IQ115	0.82	AFG	0.65 x 45B Delavan	6	0	150	L2	2	11.5	2nd & 3rd	84	0	+0.040	+0.020
MPO-IQ147	1.05	AFG	0.85 x 60B Delavan	7	1	150	L1	2	11.5	2nd	65	0	+0.040	+0.020
MPO-IQ189	1.35	AFG	1.10 X 60B Hago	7	2	150	V1 (0)	2	11.5	2nd	39	0	+0.040	+0.030
MPO-IQ231	1.65	AFG	1.35 x 60B Hago	7	2	150	V1 (3)	2	11.5	2nd	18	0	+0.050	+0.030

Notes

[1] MPO-IQ84 at 0.60 GPH firing rate utilizes a low fire baffle.

[2] The increased stack temperature with the baffles removed is an approximation, based on a constant supply temperature of 180°F and 11.5% CO_2. Actual field conditions may be different.

[3] These values are minimum and could be as much as -.03" w.c., more without impacting performance. Pressures based on 11.5% CO_2. Example: MPO-IQ231 could have a breech pressure of -.03" w.c. and an overfire pressure of .020" w.c.

4) Single stage fuel pump is standard, two-stage fuel pump is optional. Burner manufacturer has preset single stage fuel pump to settings shown in table above. Two-stage fuel pump is factory set at 140 PSI and must be readjusted to settings shown above during burner start-up.

TABLE 16B: RIELLO 40 BURNER SPECIFICATIONS - CHIMNEY VENT

Boiler Model	Burner Input (GPH)	Burner Model	Nozzle	Air Gate (setting)	Turbulator (setting)	Pump Pressure (PSI)	Combustion Head	Insertion Depth (Inch)	Approx. Shipped CO_2 (%)	Baffle Location (pass)	Approx. Stack Temp. Increase Without Baffles °F [2]	Approx. Breech Pressure (" w.c.) [3]	Baffles IN Approx. Overfire Pressure (" w.c.) [3]	Baffles OUT Approx. Overfire Pressure (" w.c.) [3]
MPO-IQ84	0.60	F3	.50 x 80°W Delavan	2.5	1.0	145	SBT 6"	2.25	11.5	3rd	52	0	+0.010	+0.005
MPO-IQ115	0.82	F3	.65 x 70°W Delavan	5.0	3.0	145	VSBT	2.25	11.5	2nd & 3rd	84	0	+0.040	+0.020
MPO-IQ147	1.05	F5	0.85 x 60°B Delavan	2.7	1.0	145	LBT 10.0"	10	11.5	2nd	65	0	+0.040	+0.020
MPO-IQ189	1.35	F5	1.10 x 60°B Delavan	4.5	3.0	150	SBT 6"	3.5	11.5	2nd	39	0	+0.040	+0.030
MPO-IQ231	1.65	F5	1.35 x 60°B Delavan	3.5	4.0	145	VSBT	2.25	11.5	2nd	18	0	+0.050	+0.030

Notes

[2] The increased stack temperature with the baffles removed is an approximation, based on a constant supply temperature of 180°F and 11.5% CO_2. Actual field conditions may be different.

[3] These values are minimum and could be as much as -.03" w.c., more without impacting performance. Pressures based on 11.5% CO_2. Example: MPO-IQ231 could have a breech pressure of -.03" w.c. and an overfire pressure of .020" w.c.

4) Single stage fuel pump is standard, two-stage fuel pump is optional. Burner manufacturer has preset single stage fuel pump to settings shown in table above. Two-stage fuel pump is factory set at 140 PSI and must be readjusted to settings shown above during burner start-up.

XV. BURNER SPECIFICATIONS (continued)

TABLE 16C: CARLIN EZ BURNER SPECIFICATIONS - CHIMNEY VENT

Boiler Model	Burner Input (GPH)	Burner Model	Nozzle	Head Setting	Air Setting	Pump Pressure (PSI)	Air Tube Type	Insertion Depth (Inch)	Approx. Shipped CO_2 (%)	Baffle Location (pass)	Approx. Stack Temp. Increase Without Baffles °F [2]	Approx. Breech Pressure (" w.c.) [3]	Baffles IN Approx. Overfire Pressure (" w.c.) [3]	Baffles OUT Approx. Overfire Pressure (" w.c.) [3]
MPO-IQ84	0.60	EZ-LF	0.50 x 60AS Danfoss	1.0	30	150	12D	2-5/8	11.5	3rd	52	0	+0.040	+0.020
MPO-IQ115	0.82	EZ-LF	0.65 x 60AS Danfoss	0.75	65	150	12D	2-5/8	11.5	2nd & 3rd	84	0	+0.040	+0.020
MPO-IQ147	1.05	EZ-66	0.85 x 45AS Danfoss	2.0	40	150	Conical Wrap	2-5/8	11.5	2nd	65	0	+0.040	+0.020
MPO-IQ189	1.35	EZ-66	1.10 x 45B Delavan	3.5	50	150	Conical Wrap	2-5/8	11.5	2nd	39	0	+0.040	+0.030
MPO-IQ231	1.65	EZ-66	1.35 x 45B Hago	5.5	60	150	Conical Wrap	2-5/8	11.5	2nd	18	0	+0.050	+0.030

Notes

[2] The increased stack temperature with the baffles removed is an approximation, based on a constant supply temperature of 180°F and 11.5% CO_2. Actual field conditions may be different.

[3] These values are minimum and could be as much as -.03" w.c., more without impacting performance. Pressures based on 11.5% CO_2. Example: MPO-IQ231 could have a breech pressure of -.03" w.c. and an overfire pressure of .020" w.c.

4) Single stage fuel pump is standard, two-stage fuel pump is optional. Burner manufacturer has preset single stage fuel pump to settings shown in table above. Two-stage fuel pump is factory set at 140 PSI and must be readjusted to settings shown above during burner start-up.

TABLE 17: BECKETT NX BURNER SPECIFICATIONS - DIRECT VENT

Boiler Model	Burner Input (GPH)	Head /Air Adjustment (setting)	Nozzle	Pump Pressure (PSI)	Approx. Shipped CO_2 (%)	Baffle Location (pass)	Approx. Stack Temp. Increase Without Baffles °F [2]	Baffles IN Minimum Overfire Pressure (" w.c.) [3]	Baffles OUT Minimum Overfire Pressure (" w.c.) [3]	Baffles IN Minimum Breech Pressure (" w.c.) [3]	Baffles OUT Minimum Breech Pressure (" w.c.) [3]
MPO-IQ147DV	1.05	2.75	Hago 0.85 - 60°B	150	11.5	2nd	75	+0.06	+0.045	+0.045	+0.03
MPO-IQ189DV	1.35	1.00	Hago 1.00 - 45°B	180			70	+0.10	+0.05	+0.08	+0.04
MPO-IQ231DV	1.65	2.25	Hago 1.25 - 45°B				23	+0.07	0	+0.06	+0.02

Notes

[2] The increased stack temperature with the baffles removed is an approximation, based on a constant supply temperature of 180°F and 11.5% CO_2. Actual field values may be different.

[3] These values are representative for max vent and air intake piping conditions @ 180°F supply water temperature and 11.5% CO_2. Actual field values may be different.

4) Single stage fuel pump is standard, two-stage fuel pump is optional. Burner manufacturer has preset single stage fuel pump to settings shown in table above. Two-stage fuel pump is factory set at 140 PSI and must be readjusted to settings shown above during burner start-up.

APPENDIX A – OIL BOILER IQ CONTROL SYSTEM

IQ Control System Overview

MPO-IQ Boiler uses a microprocessor based control system called the "IQ Control System". This "IQ Control System" consists of an IQ Oil Boiler Control in conjunction with an Oil Primary Control and an IQ Option Panel with optional "plug-in" IQ Option Cards. The IQ Control System fully integrates both factory and field installed components, simplifying installation and troubleshooting. IQ Control System is designed to efficiently operate the entire boiler system to save energy and installation and setup time, while ensuring adequate supply of heat and domestic hot water.

The IQ Option Panel works together with the IQ Oil Boiler Control to provide an easy and convenient means to "plug-in" an Auxiliary High Limit, Low Water Cut-off, and/or Outdoor Reset functions.

The Manual Reset Low Water Cutoff and High Limit IQ Option Cards are CSD-1 compliant, which simplifies installations in areas where CSD-1 is enforced. IQ Option Cards snap onto the IQ Option Panel supplied on all MPO-IQ boilers and feature Plug n' Play connections.

IQ Option Card Major Features

- Plug-'n-play connection to MPO-IQ Boilers, only wiring required is to field installed sensors
- Status and error codes displayed on built-in 3-digit display
- Optional LCD touch screen display can also be used to read status and make adjustments
- Error codes can be displayed on EnviraCOM-enabled programmable thermostat
- Built-in diagnostics
- U.S. Boiler Company factory engineered and tested as part of a complete system

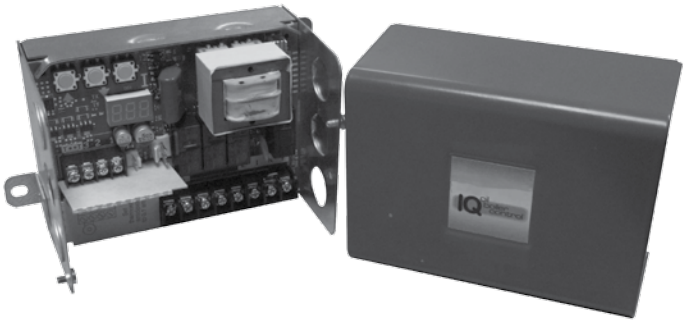
IQ Oil Boiler Control: P/N 103851-01

The IQ Oil Boiler Control replaces the familiar Honeywell L7248 electronic Aquastat and contains several additional features. These unique features allow the IQ Oil Boiler Control to connect the boiler's control system together in a way that was not previously possible, greatly simplifying set-up and troubleshooting of the boiler.

- Boiler System Display - well-known electronic aquastat 3-digit

  LED display provides the following information:
  - *Boiler Status* - Standby, pre-purge, post purge, trial for ignition, running, etc.,
  - *Diagnostics* - CAD cell resistance, run time hours and cycle counts
  - *Error Monitoring* - Including primary control and connected IQ Option Cards

  (Note: Primary control information is only available when an EnviraCOM enabled primary is connected)
- Outdoor Air Reset Ready - Operating Setpoint is automatically adjusted by outdoor air temperature and heat demand type when an Outdoor Air Reset IQ Option Card is connected. Also, Operating Setpoint is adjusted by thermostat "sleep" and "leave" modes when a setback EnviraCOM enabled thermostat is connected.
- Warm Start Ready - boiler is started and circulator is stopped when the boiler is cold and an external low limit is connected.
- Smart Circulator Pre-purge - Upon a call for heat the circulator is started and the boiler start is delayed. The boiler is started without delay if the boiler is cold or there is a DHW demand. Boiler cycling and resulting standby loses are reduced by adjusting the circulator pre-purge time.



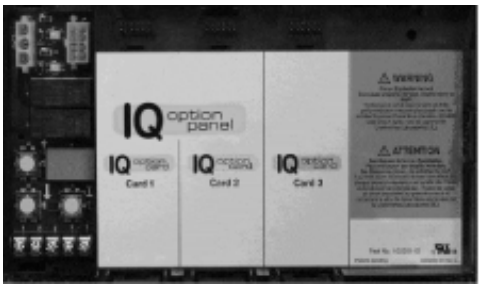
- "Energy Banking" Pump Overrun Time - The system circulator may be run after the call for heat has ended to "move" residual heat in the boiler to the system or indirect water heater.
- Second Configurable Pump Output - In addition to the system pump output the control has a second pump output and associated input that may be configured for Domestic Hot Water or second zone demand and pump control. This second output eliminates the need for an external relay for DHW pump control or the need for a zone panel used for a two zone home.

APPENDIX A – OIL BOILER IQ CONTROL SYSTEM (continued)

IQ Option Panel: P/N 102291-01

The IQ Option Panel works together with the IQ Oil Boiler Control to provide an easy and convenient means to add factory-engineered auxiliary boiler control features. When installed into the IQ Option Panel, IQ Option Cards provide plug-'n-play high temperature limit, low water cut-off and outdoor reset controls. A separate 3-digit LED readout displays settings, status and diagnostic information for all installed IQ Option Cards making them simpler and functionally superior to stand alone auxiliary controls. IQ Option Cards are available for the following features:

- Outdoor Air Reset with Domestic Hot Water Demand
- Auxiliary High Temperature Limit (available in auto reset or manual reset versions)
- Low Water Cut-off (available in auto reset or manual reset versions)



Outdoor Reset IQ Option Card: P/N 102723-01

Installing the Outdoor Reset IQ Option Card is the simplest way to maximize the efficiency of any MPO-IQ Boiler. The Outdoor Reset IQ Option Card is a microprocessor-based control that regulates the water temperature of the heating system based on the outdoor temperature. By modulating the water temperature of the heating system, the MPO-IQ Boiler equipped with an Outdoor Reset IQ Option Card will deliver annual fuel savings up to 16%, while increasing home comfort. The Outdoor Reset IQ Option Card is simple to set up yet it includes a powerful list of features that can be customized for any job.

IQ Oil Boiler Control Operating Setpoint is normally set to the High Limit Setpoint. However, when an Outdoor Reset IQ Option Card is installed the Operating Setpoint may be reduced to the outdoor reset or Domestic Hot Water (DHW) Setpoint. When an Outdoor Reset IQ Option Card is added the following user defined setpoints are available:

- High Limit Setpoint - The High Limit becomes the upper limit for the operating setpoint. The operating setpoint can not be set higher than this value. The High Limit is set to protect the boiler and hydronic system from excessive temperature.
- DHW Setpoint - The Operating Setpoint is set to the DHW Setpoint when the Outdoor Reset IQ Option Card DHW input is energized. This setpoint is set equal to the Indirect Water Heater manufacturer's recommended water temperature.
- High Boiler Water Temperature - The High Boiler Water Temperature (also known as the "Boiler Water Design Temperature") setpoint is set to the lowest boiler water temperature that will heat the home on the home's design day. This adjustment typically depends on the type and quantity radiation (heating element) installed in the home.

Kit Includes:
- Outdoor Reset IQ Option Card
- Outdoor temperature sensor
- Instructions

Major Features:
- Selectable DHWP
- Selectable/adjustable DHWP protection
- Selectable/adjustable boost feature
- Simple adjustment of reset curve

LWCO IQ Option Card (Auto Reset): P/N 102711-01
LWCO IQ Option Card (Manual Reset): P/N 102714-01

LWCO IQ Option Cards add a low water cut-off function to MPO-IQ Boilers. LWCO IQ Option Cards plug into the IQ Option Panel and connect to the system-mounted sensor with a single-wire connection. LWCO IQ Option Cards feature built-in diagnostics, probe signal strength display, and include a “Test” and “Reset” feature in compliance with UL 353 and CSA 22.2 for CSD-1 Compliance in US and Canada.

Kit Includes:
- LWCO IQ Option Card
- 3/4” NPT level sensor
- 36” wire sensor connector
- Instructions

Major Features:
- UL 353 approved
- Displays signal strength
- Warns when probe cleaning required

Hi Limit IQ Option Card (Auto Reset): P/N 102717-01
Hi Limit IQ Option Card (Manual Reset): P/N 102720-01

High Limit IQ Option Cards add auxiliary temperature limit-rated controls to MPO-IQ Boilers. High Limit IQ Option Cards plug into the IQ Option Panel and connect to a system-mounted probe with a single Molex connection. High Limit IQ Option Cards feature an adjustable set point and differential, as well as built-in diagnostics. Manual Reset models are UL 353 for CSD-1 Compliance in US and Canada.

Kit Includes:
- High Limit IQ Option Card
- Limit-rated probe with 48" lead
- 1/2" well
- Probe retainer clip
- Instructions

Major Features:
- UL 353 approved
- Error code LED and display
- Temperature display
- Electronic adjustment of high limit and differential

3.5" LCD Touch Screen Display: P/N 102728-01

The Display Kit provides a 3.5" LCD multi-color Touch Screen display for mounting in the plastic "hood" above the front door of any MPO-IQ Boiler. The Display Kit communicates with the IQ Oil Boiler Control and all installed IQ Option Cards. All boiler settings, status, and errors are displayed in full text on the bright, backlit display. All adjustments are password protected to prevent unauthorized access. Display will turn red and flash in the event of a boiler error or lock-out. Display features full-text explanations of all features and settings, as well as help screens with diagnostics and troubleshooting information.

Kit Includes:
- 3.5" Multi-color LCD touch screen
- Display software
- Enviracom gateway
- Wiring harness connectors
- Mounting bracket
- Instructions

Major Features:
- Fully assembled kit requires only 4 mounting screws and a single Molex type connection
- Adjusts all Outdoor Reset IQ Option Card parameters with graphics and help information screens
- Full English descriptive alarm displays with Recommended Corrective Action
- Real time trend displays
- Extensive Help screens to aid understanding of terminology and setup

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EnviraCOM Thermostats:

Standard EnviraCOM thermostats provide "heat demand" to the IQ Oil Boiler Control and alerts the home owner of any boiler control faults.

Connected thermostats provide a red LED and display the IQ Oil Boiler Control, Oil Primary Control or IQ Option Card Error Codes. A home owner is alerted to a problem even before the water is cold. When an Outdoor Reset IQ Option Card is installed with a setback thermostat, "leave" or "sleep" modes are used to shifts the reset curve to save energy while the home is in a reduced room temperature mode.

Honeywell VisionPro IAQ Setback Thermostat
(Honeywell P/N TH942lc1004)

SYSTEM PARTS LIST

Factory Mounted Components

Part Number	Item Description
103851-01	**IQ Oil Boiler Control** (2012) 120V, less well, Hi Limit 180°F (Default), Hi Limit Range (140° - 240°F), Hi Limit Differential 15°F (Default), Hi Limit Diff Range (10° - 30°F). Includes 12" Limit Rated Temperature Sensor, Honeywell P/N 5001464-001.
103195-01	Limit Rated Temperature Sensor, 12" length.
102291-01	**IQ Option Panel** with three slots "plug-in" option card slots, suitable for gas or oil fired boiler applications, accepts a variety of plug-in cards including limit rated cards.

Optional Components

Part Number	Item Description
102723-01	**Outside Reset IQ Option Card Kit**, Domestic Hot Water Priority, for use with IQ Option Panel, with Outside Air Temperature Sensor, Instructions, Unit Pack
102294-01	**Outdoor Reset** IQ Option Card, Domestic Hot Water Priority, for use with IQ Option Panel, less Sensor
102439-01	Outdoor Air Temperature Sensor, 12k ohm
102711-01	**LWCO IQ Option Card kit**, Hot Water LF Module, Automatic Reset, for use with IQ Option Panel, with Probe, ¾ inch NPT, Instructions, Unit Pack
102714-01	**LWCO IQ Option Card kit**, Hot Water LF Module, Manual Reset, for use with IQ Option Panel, with Probe, ¾ inch NPT, Instructions, Unit Pack
102305-01	**LWCO** Probe, ¾ inch NPT
102720-01	**Aquastat IQ Option Card Kit**, 130-220 Deg F, Manual Reset for use with IQ Option Panel, Temperature Sensor, Well, Sensor Clip, Instructions, Unit Pack
102717-01	**Aquastat IQ Option Card Kit**, 130-220 Deg F, 15 Deg F Adjustable Differential, Auto Reset, for use with IQ Option Panel, Temperature Sensor, Well, Sensor Clip, Instructions, Unit Pack
102292-01	**Aquastat** IQ Option Card, 130-220 Deg F, Manual Reset for use with IQ Option Panel, less well, Less Sensor
102293-01	**Aquastat**, IQ Option Card, 130-220 Deg F, 15 Deg F Adjustable Differential, Auto Reset, for use with IQ Option Panel, less Well, less Sensor
102295-01	Limit Rated Temperature Sensor, 36 inch length
102296-01	Limit Rated Temperature Sensor, 48 inch length
102728-01	**IQ LCD Display Kit**, Boiler Mounted, STN Monochrome, White/Red backlight, 5Vdc Power Supply, RS422 (RS485) Communication, Pure Black Bezel with Gateway, Wire Harness, Mounting Bracket, Logo Plate and Instructions
102725-01	**IQ LCD Display**, Boiler Mounted, STN Monochrome, White/Red backlight, 5Vdc Power Supply, RS422 (RS485) Communication, Pure Black Bezel
102495-01	Enviracom/Modbus RS422 Gateway and 5 Vdc Power Supply for Communication Between the IQ Control System and LCD Display, 24 Vac Power Supply Input

ADDITIONAL INFORMATION LIST

Aquastat IQ Option Card Instruction Sheet - part number 102715-01
Outdoor Reset IQ Option Card Instruction Sheet - part number 102721-01
Low Water Cut-off IQ Option Card Instruction Sheet - part number 102709-01
LCD Touch Screen Display Kit Instruction Sheet - part number 102727-01

APPENDIX B – FIGURES

Figure Number	Page Number	Description
Figure 1	6	MPO-IQ84 Thru MPO-IQ231 Water Boiler
Section I - Pre-Installation		
Figure 2A	8	Chimney Vented Boiler - Minimum Installation Clearances to Combustible Materials (Inches)
Figure 2B	9	Direct Vent Boiler - Minimum Installation Clearances to Combustible Materials (Inches)
Section II - Packaged Boiler Assembly - Trim & Controls		
Figure 3	11	Packaged Boiler Removal from Skid
Figure 4A	12	Partial Front View - Burner Swing Door Mounted to Boiler - Fully Closed and Secured
Figure 4B	13	Top View - Burner Swing Door Mounted to Cast Iron Block Assembly (Jacket Removed for Clarity)
Figure 4C	14	Top View - Burner Swing Door Fully Closed but Not Properly Secured or Sealed
Figure 4D	15	Burner Swing Door Insulation
Figure 5	15	Return Injector Piping and Relief Valve Assembly Details
Figure 6	16	Piping Arrangement for Drain Valve and Indirect Water Heating Return
Figure 7	17	Internal Junction Box and Wiring Harness Details
Figure 8	18	Baffle Orientation in Flueways
Figure 9	19	Oil Burner Installation (Beckett shown)
Section III - Unit-Pak Boiler Assembly - Trim & Controls		
Figure 10	20	MPO-IQ Unit-Pak Boiler Shipment Contents (outside container removed)
Figure 11	22	Boiler Removal from Skid
Figure 12	25	Immersion Well Probe Insertion
Section IV - Water Boiler Piping		
Figure 13A	27	Recommended Water Piping for Circulator Zoned Heating Systems
Figure 13B	28	Recommended Water Piping for Zone Valve Zoned Heating Systems
Figure 14	29	Near Boiler Piping
Section V - Natural Draft Venting		
Figure 15	31	Recommended Vent Pipe Arrangement and Chimney Requirements
Figure 16	31	Proper and Improper Locations of Draft Regulator
Figure 17	32	Smokebox Pressure Tapping for Checking Draft at Breech
Section VI - Direct Venting / Air Intake Piping		
Figure 18	34	Vent Terminal Location
Figure 19	35	Wall Cutout Dimensions
Figure 20	35	Vent Hood Body Installation
Figure 21	36	Combustion Air Tee Assembly Installation
Figure 22	36	FDVS Component Breakdown
Figure 23	37	Appliance Adapter Installation
Figure 24	37	Vent Pipe Assembly to Vent Termination Inner Pipe & Appliance Adapter
Figure 25	38	Vent Pipe Ends, Vent Termination & Appliance Adapter Sealing
Figure 26	39	Vent Pipe Assembly to Vent Termination Inner Pipe & Appliance Adapter
Figure 27	39	Oil Burner Installation (Beckett shown)

APPENDIX B – FIGURES (continued)

Figure Number	Page Number	Description
Section VII - Electrical		
Figure 28A	42	Schematic Wiring Diagram
Figure 28B	43	Schematic Wiring Diagram, Burner Options
Figure 28C	44	Ladder Diagram
Section VIII - Oil Piping		
Figure 29	45	Single Pipe Oil Line
Figure 30	46	Two Pipe Oil Lines
Section IX - System Start-Up		
Figure 31A	49	R7184 Oil Primary Terminals, LED and Reset Button
Figure 31B	49	R7284 Terminals, Display and Reset Button
Figure 32	50	Cad Cell Location
Section X - Operating		
Figure 33	52	Boiler Control & Option Panel Orientations
Figure 34	53	Boiler Control Key Function & Orientation
Section XII - Boiler Cleaning		
Figure 35	60	Cleaning of Boiler Flueways
Figure 36	62	Boiler Control User Interface
Section XIV - Repair Parts		
N/A	70 thru 80	Repair Parts

APPENDIX C – TABLES

Table Number	Page Number	Description
1A	7	Dimensional Data
1B	7	Rating Data
Section I - Pre-Installation		
Table 2	10	Direct Vent Configuration Components
Section II - Packaged Boiler Assembly - Trim & Controls		
Table 3	17	Baffle Usage
Section IV - Water Boiler Piping		
Table 4	26	Minimum Flow Rate
Section VI - Direct Venting / Air Intake Piping		
Table 5	35	Wall Cutout Dimensions
Table 6	37	Flex Vent / Vent Termination Pipe Diameters
Section VIII - Oil Piping		
Table 7	46	Two-Stage Units (3450 RPM) - Two Pipe Systems
Table 8	46	Single-Stage Units (3450 RPM) Two Pipe Systems
Section IX - System Start-Up		
Table 9	49	R7184 Cad Cell Resistance When Sensing Flame
Section X - Operating		
Table 10	52	Sequence of Operation
Table 11	54	Circulator Pre-purge Time Example, Parameter PP_= 2 minutes
Table 12A	55	Domestic Hot Water Demand, (Parameter 2C_= dH)
Table 12B	55	Domestic Hot Water Demand, (Parameter 2C_= dH) Outdoor Air Reset Option Card Installed
Table 13	55	Zone Request, Parameter 2C_= 2r
Table 14	56	External Low Limit, Parameter 2C_= ELL
Section XIII - Trouble Shooting		
Table 15A	63	Boiler Control Error Numbers
Table 15B	64 & 65	External Device (Oil Primary, Option Card, etc.) Error Numbers
Section XIV - Repair Parts		
N/A	71 thru 81	Repair Parts
Section XV - Burner Specifications		
Table 16A	83	Beckett AFG Burner Specifications - Chimney Vent
Table 16B	83	Riello 40 Burner Specifications - Chimney Vent
Table 16C	84	Carlin EZ Burner Specifications - Chimney Vent
Table 17	84	Beckett NX Burner Specifications - Direct Vent

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